

MINERALOGICAL ABSTRACTS

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Notices of Books.

MIERS (Sir Henry A.). *Mineralogy, an introduction to the scientific study of minerals.* Second edition revised by H. L. BOWMAN. London (Macmillan & Co.), 1929, xx + 658 pp., 729 + xxxii figs. Price 30s.

The first edition of this readable and well-illustrated text-book appeared in 1902 [Min. Mag. **13**-383], and during the lapse of more than a quarter of a century certain minor alterations and additions have become necessary. The work of revision has been carefully and judiciously done by the author's successor in the Chair of Mineralogy at Oxford. The original plan and text have been faithfully adhered to; in fact, many pages show little or no alteration. There is, however, an increase of 75 pages and of 59 figures (and many of the old figures have been redrawn). In the chapter on the optical properties of crystals the idea of the wave-surface has been introduced. A new section ('book') has been added on the intimate structure of crystals. This extends the old appendix of theories of crystal structure into a new chapter, and there is a good and entirely new chapter on crystal structure as determined by X-ray methods. The descriptive portion remains practically the same as before with only slight additions, and the useful tables of constants at the end of the volume have been slightly extended to include some of the more important new species. A pleasing feature is that the new edition is issued at an only slightly increased price (30s. as against 25s.), due no doubt to the omission of the coloured plates.

L. J. S.

FORD (W. E.). *Dana's Manual of mineralogy, for the student of elementary mineralogy, the mining engineer, the geologist, the prospector, the collector, etc.* 14th edition, New York (John Wiley & Sons) & London (Chapman & Hall), 1929, x + 476 pp., 10 pls., 360 text-figs. Price 20s.

Dana's 'Manual' has been going since 1848 and is more elementary in character than the 'Text-book' started in 1877, and still more elementary than the 'System' started in 1837. The present edition is practically the same as the thirteenth prepared by W. E. Ford in 1912 [Min. Mag. **16**-304], but more than double the price. There is

an increase of 16 pages with three new figures. It is a handy little volume containing a large amount of information. L. J. S.

BRAGG (*Sir William*) & BRAGG (W. L.). *Stereoscopic photographs of crystal models*. First series, nos. 1-41, with descriptive booklet (16 pp.), 1928. Price 35s. (with folding stereoscope, 38s. 9d.). Second series, nos. 1-23, with descriptive booklet (24 pp.), 1929. Price 21s. London (Adam Hilger, Ltd.).

These stereoscopic photographs of actual models give a very much clearer idea of the grouping of the atoms than can be gained from pictures in two dimensions. Pictures which when viewed in the usual way seem to be just a confused assemblage of balls and rods, when viewed in the compact little stereoscope stand out with remarkable clearness. The models themselves are rather bulky and the whole set takes up a large amount of space; but with this ingenious contrivance one may sit comfortably in an arm-chair and see the whole thing without any trouble. The two series cover a wide range of subjects, including all the mineral structures worked out by the Braggs, together with some described by other authors (e.g. garnet and thortveitite). They are up to date, including structures worked out in 1929 (e.g. staurolite, andalusite, tremolite). Whether this should be catalogued as literature or as an instrument is rather difficult to decide. The first series of 42 photographs with the folding stereoscope is put up in a flimsy cardboard box measuring $13 \times 10 \times 4$ cm. If it had been done in a neat box finished as a book, it could very well have stood on the library shelves. L. J. S.

BERNAUER (F.). "*Gedrillte*" Kristalle: *Verbreitung, Entstehungsweise und Beziehungen zu optischer Aktivität und Molekülsymmetrie*. Forschungen zur Kristallkunde,¹ Heft 2. Berlin (Borntraeger), 1929, viii + 102 pp., 13 pls., 18 text-figs. Price 20 Mk.

Twisted crystals have been believed by certain French writers to have some connexion with enantiomorphism and optical rotation. The author has examined a large number (480) of organic compounds, and by crystallizing them, usually from fusion on microscope slides, he finds that this view is incorrect. Curvature can be induced in most cases by the addition of various substances (resins, gelatin, &c.), which hinder the crystallization by starting fresh centres of growth. As an adjunct to this piece of research work, the author collects

¹ For Heft 1 of this series see H. Tertsch [M.A-3. 223].

together a few other observations on curvature in crystals, but he shows a very limited knowledge of the literature and of mineral collections. In a sketch of the subject given in this Magazine [Min. Mag. 19-263] it was suggested that a book could be written, but the present brochure entirely fails to fulfil this purpose. For the price of twenty shillings one would expect to find a balanced presentation of the subject.

L. J. S.

MOORE (Elwood S.). *Canada's mineral resources*. Toronto (Irwin & Gordon), 1929, xv + 301 pp., 14 pls. (maps). Price 21s.

This is the first volume in the 'Canadian Citizen's Library', the aim of which is to give in non-technical language an authoritative survey of the economic and social life of Canada. The book, written by the Professor of Economic Geology in the University of Toronto, gives in a handy form much useful information regarding the occurrence and statistics of production of the many minerals, metallic and non-metallic, that are mined in Canada. The information is collected in chapters headed iron, lead and zinc, precious metals, coal and peat, refractory materials, &c., and for each of these a sketch-map shows the distribution. Since 1886 the annual value of the mineral production has increased more than twenty-fold, and since 1910 it has been more than doubled.

L. J. S.

PIRSSON (Louis V.) [1860-1919] & SCHUCHERT (Charles). *A textbook of geology. Part I—Physical geology*. 3rd edition edited by Chester R. LONGWELL. New York (John Wiley & Sons) & London (Chapman & Hall), 1929, vii + 488 pp., 1 pl., 322 text-figs. Price 18s. 6d.

The late L. V. Pirsson's volume on physical geology first appeared in 1905, and a second edition, prepared by himself, was issued shortly after his death. The present edition shows many alterations and improvements, made by six members of the Department of Geology in Yale University, who have been responsible for different chapters. Many new landscape views and diagrams have been added. The result is an excellent and readable elementary text-book, which is attractively illustrated and printed. A chapter on sedimentary rocks follows that on oceans and seas; volcanic rocks follow on after the chapter on volcanoes; and metamorphic rocks follow the chapter on warping, folding, and fracturing. There is an interesting chapter on the earth's interior, a short one on ore-deposits, and a brief appendix on minerals.

L. J. S.

NIGGLI (Paul). *Ore deposits of magmatic origin: their genesis and natural classification*. Translated from the original German edition by H. C. BOYDELL, revised and supplemented throughout by Dr. NIGGLI and R. L. PARKER. London (Murby & Co.), 1929, xi + 93 pp., 12 figs. Price 9s. 6d.

The scope of this essay was outlined in a notice of the German edition [M.A. 3-1], but a few words may now be added on the classification proposed, which is dealt with in three chapters. (1) Consideration of the behaviour expected from magmatic melts rich in volatile constituents under varying degrees of pressure leads to the recognition of three stages in the process of differentiation, namely, *orthomagmatic*, *pegmatitic* and *pneumatolytic*, and *hydrothermal*. (2) The application of principles which have been followed in the classification of igneous rocks is shown to result in a natural classification of magmatic ore-deposits in which there is, in the first place, a two-fold division into *plutonic* and *volcanic* deposits. (3) In the third part of the book the author discusses the association of magmatic ore-deposits in relation to tectonic units and in relation to igneous rock provinces (that is, to certain courses of differentiation). Some kinds of ore-deposits are found to be associated with basic rock types which are regarded as relatively undifferentiated: such must be derived from ore-magmas removed before the commencement of the normal course of differentiation of the hypothetical gabbroid magma. Other ore-deposits result from the normal process of differentiation. This gives another two-fold division. Finally, some deposits not associated with visible igneous rocks, including large lead-zinc deposits, many of which are usually regarded as non-magmatic, are considered to be *telemagmatic*, owing their origin to distant deep-seated magma-basins. These are the main lines on which the classification is based. In the course of their discussion many interesting problems are raised, and an English translation of the book is therefore welcome.

W. C. S.

Chemical Constitution of Silicates.

EITEL (Wilhelm). *Die Konstitution der Silikate*. Die Naturwissenschaften, 1928, vol. 16, pp. 421-423.

A short critical account is given of the important theories of the constitution of the silicates and the advances made by the modern structural theory based on X-ray investigation. Little light, however, has been thrown on the physical properties, such as the electrical

conductivity, the dielectric properties, fluorescence, &c.; and the problems of the constitution of the silicates in the colloidal state have yet to be solved.

F. A. B.

HERLINGER (E.). *Neuere Theorien über die Konstitution der Silicate.*

I. Über die neueren Grundlagen der Konstitutionuntersuchung an Silicaten. Zeits. Angewandte Chem., 1928, vol. 41, pp. 489-493.

The chemical and newer physical theories on the constitution of the silicates are discussed. It is now supposed that most of the silicates are complicated structures built out of a few characteristic atomic groups in changing number relationships and with variable chemical isomorphism. The structure of silica is of chief importance for structural considerations, whilst the aluminium atom is the nucleus of greater atomic complexes in aluminosilicates. F. A. B.

THIESSEN (P. A.) & KOERNER (O.). *Ortho- und Pyrokieselensäure.* Zeits. Anorg. Chem., 1929, vol. 182, pp. 343-350, 2 figs.

By slow decomposition of ethyl orthosilicate with dilute alcohol and careful dehydration of the coarse gel resulting, three definite silicic acids were obtained: orthosilicic acid H_2SiO_4 , pyrosilicic acid $\text{H}_6\text{Si}_2\text{O}_7$, and metasilicic acid H_4SiO_3 .

M. H. H.

BRAGG (W. Lawrence). *Atomic arrangement in the silicates.* Trans. Faraday Soc. London, 1929, vol. 25, pp. 291-314, 18 figs.

A general account and recapitulation of the structures that, since 1926, have been determined by X-ray methods in the Physical Laboratories of the University of Manchester by the author and his co-workers for a number of mineral silicates, viz. beryl, phenakite, olivine, monticellite, norbergite, chondrodite, humite, clinohumite, zircon, topaz, staurolite, kyanite, fibrolite, mullite, andalusite, and diopside. [M.A. 3-185, &c.; 4-31, &c.]

L. J. S.

GOSSNER (B.). *Über strukturelle Beziehungen bei Silicaten.* Ber. Deutsch. Chem. Gesell., 1928, vol. 61, pt. B, pp. 1634-1638.

When examined by X-ray methods the silicates show certain structural relations which are not evident by ordinary crystallographic methods. Repetitions of the same type of structure are illustrated by the following three groups, in each of which the dimensions of the unit cell are approximately the same, and the number of the oxygen atoms and the total number of the other atoms are the same in each cell. (1) Babingtonite, $\text{Si}_2\text{O}_6\text{CaFe.SiO}_2$, anorthite, $\text{Si}_2\text{O}_5\text{Ca.Al}_2\text{O}_3$,

and epididymite $\text{Si}_2\text{O}_5\text{Be.SiO}_3\text{NaH}$; (2) beryl, $3\text{Si}_2\text{O}_5\text{Be.Al}_2\text{O}_3$, and cordierite, $\text{Si}_5\text{O}_{12}\text{Mg}_2.2\text{Al}_2\text{O}_3$; (3) diopside, $\text{Si}_2\text{O}_6\text{MgCa}$, and tremolite, $\text{Si}_4\text{O}_{12}\text{Mg}_3\text{Ca}$. The structure thus appears to be governed by the number of oxygen atoms, as suggested by W. L. Bragg [M.A. 3-342].

L. J. S.

GOSSNER (B.). *Beitrag zur Stöchiometrie der Silicate*. Zeits. Angewandte Chem., 1929, vol. 42, pp. 175-178.

Careful analyses were made in duplicate on specially selected pure materials with the object of testing the exactness of the stoichiometric ratios. Analyses by A. R. Tourky of olivine: I, clear green coarse-grained inclusions in basalt from Grossschlattengrün, Ober-Pfalz; II, bottle-green inclusions in basalt from Zeilberg, Rhön; III, in basalt from Dockweiler, Eifel; IV, water-worn crystals from the 'Orient'. The ratios $\text{SiO}_2:\text{RO}$ vary from 1:1.93 to 1:1.99, showing a slight excess of silica; but when the water (expelled only at 1100°C .) [M.A. 3-377] is included with the bases the silica shows a slight deficiency, $\text{SiO}_2:\text{RO}$ then varying from 1:2.00 to 1:2.05. Analyses V-VII, by M. Arm and F. Spielberger, of almandine from Irschenrieth, Ober-Pfalz. The ratios $\text{R}_2\text{O}_3:\text{RO}:\text{SiO}_2$, in V 1:2.61:2.66, in VI 1:2.61:2.71, and in VII 1:2.54:2.69, in all cases show an excess of both alumina and silica over that required by the fundamental garnet formula $3\text{SiO}_3\text{Fe.Al}_2\text{O}_3$ [i. e. $\text{R}_2\text{O}_3.3\text{RO}.3\text{SiO}_2$]. The excess of aluminium is explained by the isomorphous replacement of Al_2 for SiFe (or Al_2O_3 for FeSiO_3) to the extent of 3 mol. %; and the excess of silica over that required for RSiO_3 may perhaps be explained by it filling up odd spaces in the crystal-structure, or perhaps by an isomorphous replacement of silicon for aluminium. Analysis VIII, by O. Kraus, of water-clear sanidine from Wehr, Laacher See, shows, on the other hand, a deficiency in silica, namely 1.077 mol. instead of 1.128 required by the felspar formula.

	SiO_2 .	Al_2O_3 .	Fe_2O_3 .	FeO .	MnO .	MgO .	CaO .	H_2O .	Total.	Sp. gr.
I.	41.44	—	—	9.04	—	46.86	2.20	0.83	100.37	3.350
II.	40.82	—	0.06	10.12	0.06	48.68	—	0.81	100.55	3.357
III.	41.54	—	—	7.95	—	49.81	—	0.83	100.13	3.346
IV.	40.70	—	—	11.15	—	47.45	—	0.79	100.09	3.409
V.	36.10	22.22	1.24	29.75	6.86	1.21	2.81	—	100.19	4.265
VI.	36.24	22.25	0.79	28.80	8.81	1.31	1.49	—	99.69	4.228
VII.	36.79	22.11	1.85	27.61	9.05	1.54	1.74	—	100.69	4.025
VIII.	64.61	18.72	0.33	—	—	—	0.37	0.40	100.38 ¹	2.568

¹ Including K_2O 12.87, Na_2O 3.08.

L. J. S.

SCHARIZER (Rudolf). *Stöchiometrische Betrachtungen*. Neues Jahrb. Min., Abt. A, 1928, vol. 57, pp. 57–62.

An attempt is made to explain the break-up of plagioclase into albite and zoisite, the association of potash-felspar with muscovite and biotite, and the change of leucite to pseudo-leucite, by the aid of structural formulae on the lines of organic chemistry. M. H. H.

GOßNER (B.) & SPIELBERGER (F.). *Chemische und röntgenographische Untersuchungen an Silikaten. Ein Beitrag zur Kenntnis der Hornblende-Gruppe*. Zeits. Krist., 1929, vol. 72, pp. 111–142.

Further determinations [M.A. 4–108–110] on minerals of the amphibole group made by the rotating crystal-method gave the following values:

		a.	b.	c.	β .
Basaltic hornblende ¹	...	9.88	18.10	5.31 Å.	74° 15'
Arfvedsonite	...	9.87	18.31	5.33	„
Barkevikite	...	9.92	18.30	5.33	„
Kaersutite	...	9.85	18.17	5.39	„
Aenigmatite	...	10.02	14.73	5.12	101° 58', α and γ about 90°.

All these, except aenigmatite, can be referred to the general formula ('Bauplan' or building scheme) $\text{Si}_2\text{O}_6\text{Mg}_2.\text{Si}_2\text{O}_6\text{MgCa}$ [i. e. the tremolite formula $\text{CaMg}_3(\text{SiO}_3)_4$] with four such molecules in the unit cell, or eight molecules of the type $\text{R}_2\text{Si}_2\text{O}_6$. Individual analyses are explained by the isomorphous mixing of a great variety of molecules derived by replacement from these two part molecules: e. g. $\text{Si}_2\text{O}_6\text{MgCa}$ may be replaced by $\text{Si}_2\text{O}_6\text{Mg}_2$, $\text{Si}_2\text{O}_6\text{Na}_2\text{H}_2$, $\text{Si}_2\text{O}_6\text{Na}_4$, $\text{Si}_2\text{O}_6\text{AlNa}$, and finally by $\text{Al}_2\text{O}_6\text{Na}_2\text{H}_4$; while $\text{Si}_2\text{O}_6\text{Mg}_2$ changes into $\text{Ti}_2\text{O}_6\text{Fe}_2$, Al_4O_6 , or Fe_4O_6 . Aenigmatite and cossyrite present a difficulty, and new values [M.A. 4–108] for the axial ratios, unit cell, and orientation are now adopted. Of various alternative formulae, the general formula $6\text{SiO}_3\text{Fe}.\text{TiO}_3\text{Fe}$ appears the most probable with two molecules in the unit cell, or seven molecules of the general type $\text{R}_2\text{Si}_2\text{O}_6$. Aenigmatite therefore does not strictly fall into the amphibole group. Similarly, rhodonite and wollastonite do not conform with the monoclinic pyroxenes, which contain four molecules $\text{R}_2\text{Si}_2\text{O}_6$ in the unit cell, nor with the orthorhombic pyroxenes with eight molecules $\text{R}_2\text{Si}_2\text{O}_6$. Chemical analyses of the materials used for the X-ray measurements are: I, arfvedsonite, sp. gr. 3.48–3.50, from Greenland;

¹ Black basaltic hornblende from Bohemia, correction of data previously given [M.A. 4. 110]. The space-group is now given as C_{2h}^6 .

II (sp. gr. 3.35–3.37) and III (sp. gr. 3.40–3.438), barkevikite from Barkevik, Norway; IV, kaersutite, sp. gr. 3.20–3.21, from Kaersut, Greenland; V, aenigmatite, sp. gr. 3.84–3.86, from Greenland; VI, aenigmatite, sp. gr. 3.81–3.84, from Kola, Russia; VII, cossyrite, sp. gr. 3.762–3.817, from Pantelleria. No optical data are given.

	I.	II.	III.	IV.	V.	VI.	VII.
SiO ₂ ...	46.55	41.49	42.15	39.50	39.46	39.58	42.47
TiO ₂ ...	0.38	—	2.43	10.33	7.78	7.19	7.95
Al ₂ O ₃ ...	1.43	11.60	4.84	11.12	4.20	4.02	1.11
Fe ₂ O ₃ ...	0.79	2.89	5.94	0.06	3.04	4.92	1.59
FeO ...	35.81	21.94	21.51	9.44	39.24	34.07	33.31
MnO ...	0.71	0.79	1.30	0.10	0.63	2.54	1.74
MgO ...	0.05	8.39	5.68	12.90	0.19	0.75	0.50
CaO ...	3.73	9.86	8.42	10.91	2.42	2.30	2.49
Na ₂ O ...	6.62	2.07	3.46	3.82	3.30	3.72	3.66
K ₂ O ...	2.47	0.58	0.95	1.43	0.11	0.26	—
H ₂ O ...	1.69	0.93	0.99	0.59	0.32	0.49	—
Total ...	100.23	100.54	100.67	100.20	100.69	99.83	99.82

In I, only 0.1 % H₂O is lost up to 1000°C.

L. J. S.

KUNITZ (W.). *Beiträge zur Kenntnis der magmatischen Assoziationen II.* (Die Mineralien der Hauptkristallisation; die melanokraten Bestandteile.) *Die Isomorphieverhältnisse in der Hornblendegruppe.* Neues Jahrb. Min., Abt. A, 1930, vol. 60, pp. 171–250, 12 figs. [Preprints dated 1929.]

Sixty-one chemical analyses with density and optical determinations are given for various rock-forming members of the amphibole group. The materials were separated by heavy liquids in a centrifugal apparatus from the finely powdered rocks. Seven isomorphous series are distinguished and these fall into two groups, viz. those (1–4) from crystalline schists and those (5–7) from igneous rocks.

- (1) Anthophyllite, $\text{H}_2\text{Mg}_7\text{Si}_8\text{O}_{24}$ —Grünerite, $\text{H}_2\text{Fe}_7\text{Si}_8\text{O}_{24}$.
- (2) Tremolite, $\text{H}_2\text{Ca}_2\text{Mg}_5\text{Si}_8\text{O}_{24}$ —Actinolite, $\text{H}_2\text{Ca}_2\text{Fe}_5\text{Si}_8\text{O}_{24}$.
- (3) Glaucophane, $\text{H}_2\text{Na}_2\text{Mg}_3\text{Al}_2\text{Si}_8\text{O}_{24}$ —Riebeckite, $\text{H}_2\text{Na}_2\text{Fe}_3\text{Fe}''_2\text{Si}_8\text{O}_{24}$.
- (4) Glaucophane, $\text{H}_2\text{Na}_2\text{Mg}_3\text{Al}_2\text{Si}_8\text{O}_{24}$ —Tremolite, $\text{H}_2\text{Ca}_2\text{Mg}_3\text{Mg}_2\text{Si}_8\text{O}_{24}$.
- (5) Common green hornblendes
(mixtures of syntagmatite
and tremolite-actinolite
molecules) $\left\{ \begin{array}{l} \text{H}_2\text{Ca}_2\text{Mg}_4\text{Al}_2\text{Si}_6\text{O}_{22} \text{—} \text{H}_2\text{Ca}_2\text{Fe}_4\text{Al}_2\text{Si}_6\text{O}_{22} \\ \text{H}_2\text{Ca}_2\text{Mg}_5\text{Si}_8\text{O}_{24} \text{—} \text{H}_2\text{Ca}_2\text{Fe}_5\text{Si}_8\text{O}_{24} \end{array} \right.$
- (6) Syntagmatitic hornblendes
(including pargasite and
basaltic hornblende) $\left\{ \begin{array}{l} \text{H}_2\text{Ca}_2\text{Mg}_4\text{Al}_2\text{Si}_6\text{O}_{22} \text{—} \text{H}_2\text{Ca}_2\text{Fe}_4\text{Al}_2\text{Si}_6\text{O}_{22} \\ \text{H}_2\text{Ca}_2\text{Mg}_4\text{Al}_2\text{Si}_6\text{O}_{22} \text{—} \text{H}_2\text{Ca}_2\text{Fe}_4\text{Al}_2\text{Si}_6\text{O}_{22} \end{array} \right.$
- (7) Alkali-iron-amphiboles
(imerinite, hastingsite, ka-
tophorite, arfvedsonite) $\left\{ \begin{array}{l} \text{H}_2\text{Na}_2\text{Mg}_4\text{Si}_8\text{O}_{22} \text{—} \text{H}_2\text{Na}_2\text{Fe}_4\text{Si}_8\text{O}_{22} \\ \text{H}_2\text{Na}_2\text{Mg}_4\text{Si}_8\text{O}_{22} \text{—} \text{H}_2\text{Na}_2\text{Fe}_4\text{Si}_8\text{O}_{22} \end{array} \right.$

In several of these series the density and refractive indices show a regular increase with increasing iron. In the basaltic hornblendes the refractive indices also increase with the percentage of TiO_2 . The formulae show the replacement of $[\text{NaAl}]$ for $[\text{CaMg}]$ and of $[\text{NaSi}]$ for $[\text{CaAl}]$. These isomorphous replacements are discussed in their relation to the sizes of atoms, and to the separation of hornblende, augite, or mica from the magma.

L. J. S.

WARREN (B. E.). *The structure of tremolite $\text{H}_2\text{Ca}_2\text{Mg}_5(\text{SiO}_3)_8$* . Zeits. Krist., 1929, vol. 27, pp. 42-57, 6 figs.

WARREN (Bertram Eugene). *An X-ray determination of the structure of the metasilicates*. Thesis for degree of D.Sc., 1929, abstract published in Abstracts of Scientific and Technical Publications from the Massachusetts Institute of Technology, Cambridge, Mass., 1929, no. 4, pp. 74-75. [Dealing with diopside (M.A. 4-31) and tremolite.]

Tremolite from a New York locality gave by the rotating-crystal method the cell dimensions $a = 9.78$, $b = 17.8$, $c = 5.26$ Å. ($a : b : c = 0.550 : 1 : 0.295$, $\beta = 73^\circ 58'$). Except for the double length of the b -axis, these dimensions are very close to those of diopside [M.A. 4-31]. The space-group is C_{2h}^3 , and two molecules $\text{H}_2\text{Ca}_2\text{Mg}_5(\text{SiO}_3)_8$ are contained in the unit cell. The arrangement of the atoms is also very similar to that in diopside, but with certain modifications. Tetrahedral groups of four oxygen atoms surrounding each silicon atom are linked by shared oxygens to form endless chains parallel to the c -axis. Two such diopside chains are linked together and there are four chains in the unit cell. The calcium and magnesium atoms, all lying on diad axes, are surrounded by eight and six oxygens respectively. Such a structure will accommodate only ten magnesium atoms in the unit cell; and the two extra ones required by the usually accepted formula $\text{CaMg}_3(\text{SiO}_3)_4$ are replaced by four (OH) groups, which occupy the same space as four oxygens. This new formula¹ $\text{H}_2\text{Ca}_2\text{Mg}_5(\text{SiO}_3)_8$, for tremolite is identical with that of W. Kunitz (preceding abstract), and it agrees well with the analyses of Penfield and Stanley (1907) and of Allen and Clement (1908) when these are recalculated with small isomorphous replacements (Si, Al), (Mg, Fe), (Ca, Na, K), and (OH, F). The new formula requires 2.2 % H_2O . The crystal-structure explains the fibrous texture of the mineral and the prism-cleavage of 56° .

L. J. S.

¹ First given by W. T. Schaller, Bull. U.S. Geol. Survey, 1916, no. 610, p. 136.

MACHATSCHKI (Felix). *Über die Formel der monoklinen Amphibole und Pyroxene.* Zeits. Krist., 1929, vol. 71, pp. 219-236.

The chemical analysis of a hypersthene-hornblende rock from Greenland [M.A. 4-223] cannot be explained by the usual amphibole formulae nor by the mixing of part molecules. The general formula deduced is $XY_3(\text{Si}, \text{Al})_4(\text{O}, \text{OH}, \text{F})_{12}$, where $X = \text{Ca}, \text{Na}, \text{K}$, and $Y = \text{Mg}, \text{Fe}'', \text{Fe}''', \text{Al}$, also Ti and Mn , and the special formula for the hornblende in this rock is $(\text{Ca}_3\text{Na})(\text{Mg}_9\text{Fe}''_2\text{Fe}''')(\text{Al}_3\text{Si}_{13})(\text{O}_{45}[\text{OH}]_3)$. The mutual replacement of atoms depends, not on their valencies, but on their sizes being such that they will fit into the crystal-structure with a certain accommodation between different pairs (e. g. Al for Si together with OH for O). Any variation shown by the monoclinic amphiboles in the ratio $X:Y$ from 1:3 is further explained by an interchange of atoms between these two groups. On the same lines the general formula of the monoclinic pyroxenes is written $X_2Y_2(\text{Si}, \text{Al})_4(\text{O}, \text{OH}, \text{F})_{12}$. Structural formulae as chains of SiO_4 -tetrahedra are given.

L. J. S.

MOROZEWICZ (Józef). *O składzie chemicznym nefelinu skałotwórczego.*—

Über die chemische Zusammensetzung des gesteinsbildenden Nephelins. Bull. Acad. Polonaise Sci. Lett., Cl. Sci. Math. Nat., Ser. A, Sci. Math., Cracovie, 1928, pp. 111-125.

A review is given of the author's paper of 1907 on the chemical composition of nepheline (elaeolite) and of later papers by other authors on the same subject. The following new analyses of elaeolite (I-III, from the mariupolite rocks of Mariupol, Russia; IV, from the ditroite of Ditró, Romania) agree with the formula $\text{K}_2\text{Na}_8\text{Al}_{10}\text{Si}_{11}\text{O}_{42}$ or $\text{K}_2\text{Al}_2\text{Si}_3\text{O}_{10} \cdot 4\text{Na}_2\text{Al}_2\text{Si}_2\text{O}_8$, regarded as a double salt rather than an isomorphous replacement of potassium and sodium. Partial analyses are also given of the rocks from which each sample of the mineral was isolated; they show SiO_2 54.95 to 62.86, and the ratio $\text{K}_2\text{O}:\text{Na}_2\text{O}$ ranges from 1:2.3 to 1:23.6. In spite of this range in the alkalis in the rock, in the mineral $\text{K}_2\text{O}:\text{Na}_2\text{O}$ is 1:4 or 1:4.5.

	SiO_2 .	TiO_2 .	Al_2O_3 .	Fe_2O_3 .	CaO .	Na_2O .	K_2O .	H_2O .	Total.
I.	43.08	0.11	32.41	0.33	0.16	15.83	6.37	1.73	100.02
II.	43.65	0.10	33.12	0.48	0.49	15.91	5.69	0.74	100.18
III.	43.33	—	33.97	0.30	0.12	16.07	5.40	0.96	100.15
IV.	42.64	0.04	32.99	0.41	0.30	16.17	6.22	1.10	99.87

L. J. S.

MALMQVIST (David). *Studien innerhalb der Epidotgruppe mit besonderer Rücksicht auf die manganhaltigen Glieder.* Bull. Geol. Inst. Upsala, 1929, vol. 22, pp. 223–280, 15 figs.

A very thorough study of the optical properties of the epidote group has been made, using analysed material throughout. The refractive indices, optic axial angle, and position of the optical ellipsoid have been measured, and the absorption surface has been studied and fully determined with a simply constructed microphotometer adapted from an ordinary polarizing microscope fitted with a Fedorov universal stage. The variation of the optical properties with the chemical composition is fully discussed, and it is shown that a complete determination of the five principal constituents, Fe_2O_3 , Mn_2O_3 , Al_2O_3 , CaO , and MnO , may be made by three suitable optical measurements, preferably two refractive indices and an absorptive index, or one refractive index and two absorptive indices. The bibliography includes many useful references to work on the absorptive properties of pleochroic crystals. M. H. H.

GOßNER (B.). *Die Beziehungen von Davyn zu Häüyn.* Centr. Min., Abt. A., 1925, pp. 169–177.

From a discussion of published analyses the following formulae are deduced: $3[\text{SiO}_3\text{Na}_2\cdot\text{SiO}_2\cdot\text{Al}_2\text{O}_3]\cdot 2\text{CaSO}_4$ for häüyne and $3[\text{SiO}_3\text{Na}_2\cdot\text{SiO}_2\cdot\text{Al}_2\text{O}_3]\cdot\text{CaSO}_4\cdot\text{CaCl}_2$ for davyne. In addition, a crystallographic relationship is traced. It is concluded that davyne is a double compound between häüyne and a hypothetical calcium-sodalite. [Cf. M.A. 2–421.] F. A. B.

KUNITZ (Wilh.). *Beiträge zur Kenntnis der magmatischen Assoziationen I. (Die Mineralien der Restkristallisation; pegmatitisch-pneumatolytisches Bildungsstadium.) Die Mischungsreihen in der Turmalingruppe und die genetischen Beziehungen zwischen Turmalinen und Glimmern.* Chemie der Erde, 1929, vol. 4, pp. 208–251.

Twenty new chemical analyses, together with density and refractive index determinations, are given of tourmaline from various localities. The tourmalines are divided into two series: (1) the dravite series of magnesium-iron-tourmalines, (2) the rubellite series of lithium-iron-tourmalines; and the chemical composition in each series is explained by the isomorphous mixing of two molecules, giving in all three molecules: a dravite molecule, $\text{H}_8\text{Na}_2\text{Mg}_6\text{Al}_{12}\text{Si}_{12}\text{B}_6\text{O}_{62}$; a schorl

(iron) molecule, $H_8Na_2Fe_6Al_{12}Si_{12}B_6O_{62}$; and a rubellite molecule, $H_8Na_2[LiAl]_3Al_{12}Si_{12}B_6O_{62}$. In each series the density and refractive indices show a regular increase with increase in the percentage of the iron molecule present. In the dravite series the vertical crystallographic axis c shows a slight decrease with increasing iron. Three further molecules are invoked to explain the composition of tourmalines richer in Ca, Mn, or Al, viz. $H_8Ca_2Mg_8Al_{10}Si_{12}B_6O_{62}$ ('uvite'), $H_8Na_2Mn_6Al_{12}Si_{12}B_6O_{62}$ ('tsilaisite'), and $H_8Na_2Fe_5Al_{14}Si_{11}B_6O_{62}$. Remarks are added on the role of lithium in the silicates: it does not accommodate itself with the alkalis, but forms a group $[LiAl]$ replacing $[MgCa]$ or $[MgMg]$, or in the micas as $[Li_2Si]$ replacing $'Fe''$]₃. The frequent alteration of tourmalines to micas and their association in rocks suggests a relation between their chemical constitution, which it is the aim of the formulae to bring out. Notes are given on the occurrence of boron minerals with a bibliography [which contains many misprints].

L. J. S.

BERMAN (Harry). *Composition of the melilite group*. Amer. Min., 1929, vol. 14, pp. 389-407, 1 fig.

Twenty-three published analyses of åkermanite, humboldtilite, melilite, gehlenite, and sarcolite are tabulated and the atomic composition of each is calculated with oxygen at 70. A general formula for the whole group is deduced as $(Ca + Na)_{20-x}Mg_yAl_zSi_{30-(y+z)}O_{70}$, where $x = 0$ to 3, $y = 0$ to 10, and $z = 0$ to 20. End-members of the series are: åkermanite, $Ca_2MgSi_2O_7$; gehlenite, $Ca_2Al_2SiO_7$; sodamelilite, $Na_2Si_3O_7$; and sub-melilite, $CaSi_3O_7$.

L. J. S.

MACHATSCHKI (Felix). *Die Formeleinheit des Turmalins*. Zeits. Krist., 1929, vol. 70, pp. 211-233; 1929, vol. 71, pp. 45-46.

A general formula of the type $XY_9B_3Si_6H_xO_{31}$ is deduced for tourmaline, X and Y representing groups of atoms ($X = Ca, Na$, and some Mn'' , and $Y = Li, Mg, Mn, Fe, Al$) arranged according to size and not necessarily valency. Most modern analyses appear to agree with this formula. Rotation photographs yield $a = 16.02$, $c = 7.22 \text{ \AA}$. for black tourmaline from Grundesund, Norway, $a = 15.81$, $c = 7.10 \text{ \AA}$. for rose-red tourmaline from San Diego, California, and $a = 15.87$, $c = 7.13 \text{ \AA}$. for pale-pink tourmaline from Pala, California. The hexagonal unit cell contains three molecules $XY_9B_3Si_6H_xO_{31}$.

F. A. B.

- JAKOB (Johann). *Beiträge zur chemischen Konstitution der Glimmer*.
 IV. Mitteilung: Die Phlogopite. I. Teil. Zeits. Krist., 1928,
 vol. 69, pp. 217-225.
- — V. Mitteilung: Die Muskovite der Pegmatite. II. Teil.
 Ibid., 1929, vol. 69, pp. 403-410.
- — VI. Mitteilung: Die nicht pegmatitischen Muskovite. I. Teil.
 Ibid., 1929, vol. 69, pp. 511-515.
- — VII. Mitteilung: Die Muskovite der Pegmatite. III. Teil.
 Ibid., 1929, vol. 70, pp. 493-496. [Cf. M.A. 2-423, 3-81,
 3-376.]

Ten new analyses are given of phlogopite, eighteen of pegmatitic muscovite, and eight of non-pegmatitic muscovite from various localities. Optical data are given in some cases for the material analysed. It is found that the ratio of the number of molecules containing sesquioxides to those that do not is approximately 1:1, 3:2, or 2:3 for micas of the phlogopite type. The chemical constitution of the muscovites is much more complicated than is ordinarily assumed.

H. H.

- KUNITZ (W.). *Enthalten die Muskovite und Biotite Kalk?* Zeits. Krist., 1929, vol. 70, pp. 508-515.

A mica which was found by the author [M.A. 2-424] to contain 1.8% CaO was analysed by J. Jakob [preceding abstract] and found free from calcium. The author therefore had the analysis repeated, and verified the accuracy of J. Jakob's result. A general discussion on the composition of mica is added.

H. H.

- WINCHELL (A. N.). *Isomorphous relations of $MgSiO_3$ and $AlAlO_3$ in silicates*. Amer. Min., 1928, vol. 13, pp. 52-56, 2 figs.

The presence of Al_2O_3 (up to 15%) in minerals of the amphibole and pyroxene groups is well known, and the isomorphism of the molecules $Ca_2MgSi_2O_7$ (åkermanite) and $Ca_2Al_2SiO_7$ (gehlenite) and of $H_4Mg_3Si_2O_9$ (antigorite) and $H_4Mg_2Al_2SiO_9$ (amesite) is significant in this connexion. The author believes that a similar replacement of $AlAlO_3$ and $MgSiO_3$ takes place in the mica group, rather than the replacement of RO and Al_2O_3 as suggested by A. F. Hallimond. Graphs are given plotting $MgO + FeO + MnO$ against $K_2O + Na_2O$ (+CaO) for analyses of mica. Hallimond's views on the constitution of the micas are further criticised [M.A. 3-374], and the ratio $K_2O : SiO_2$ is not accepted as a constant at 1:6.

L. J. S.

HALLIMOND (A. F.). *Studies in the mica group (a discussion)*. Amer. Min., 1928, vol. 13, p. 451-452.

A further reply to A. N. Winchell. [Cf. M.A. 3-3]

WINCHELL (A. N.). *The composition of muscovite (further discussion)*. Amer. Min., 1928, vol. 13, pp. 567-569.

WINCHELL (A. N.). *Additional notes on chlorite*. Amer. Min., 1928, vol. 13, pp. 161-170, 3 figs.

A discussion and criticism of J. Orcel's memoir [M.A. 3-372] on the chlorites, and the new data are plotted on the author's diagram [M.A. 3-373]. As opposed to Orcel, the author considers that these data support Tschermak's theory of the isomorphous mixing of amesite and antigorite molecules. The X-ray powder patterns, as also the dehydration curves, however, show no conclusive results in support of this theory. The possibility of an optically isotropic chlorite is further discussed.

L. J. S.

HALLIMOND (A. F.). *The formula of glauconite*. Amer. Min., 1928, vol. 13, pp. 589-590.

A criticism of H. Schneider's formula $(K,Na)(Fe,Mg)(Fe,Al)_3Si_6O_{18} \cdot 3H_2O$ (Journ. Geol., 1927, vol. 35, pp. 289-310) with recalculation of the molecular ratios from the new and old analyses. [Cf. Min. Mag. 19-330.]

L. J. S.

Crystal-optics.

HAVELOCK (T. H.). *The dispersion of double refraction in quartz*. Proc. Roy. Soc. London, Ser. A, 1929, vol. 124, pp. 46-49.

The relation $1/(n_1^2 - 1) - 1/(n_2^2 - 1) = C$ is recalculated using recent experimental data. [Proc. Roy. Soc. London, Ser. A, 1907, vol. 80, p. 80, & M.A. 4-56, 4-57]. For wave-lengths between 4,000 and 8,000 Å., it is possible to calculate the double refraction with great accuracy.

F. A. B.

WINCHELL (A. N.). *Dispersion of minerals*. Amer. Min., 1929, vol. 14, pp. 125-149.

A useful table collects together the determined values for minerals of the dispersion of the refractive index (n , ω , or β), with references to the literature. The values are reduced to the standard F-C (blue to red) and arranged numerically from 0.0039 for villiaumite to 0.55 for tenorite. Forty-one minerals with a dispersion higher than that of diamond (0.0251) are listed. Dispersion may at times be of

determinative value; e. g. 0.026 for mullite and 0.01–0.012 for fibrolite.

L. J. S.

EHRINGHAUS (A.). *Dispersion der Rotationsdoppelbrechung bei natürlich- und magnetisch-optisch-aktiven Kristallen und Flüssigkeiten.* Zeits. Krist., 1929, vol. 71, pp. 183–204.

From determined values of the double refraction of rotation for different wave-lengths the reciprocal relative dispersion $R = \rho_D \lambda_D / (\rho_F \lambda_F - \rho_C \lambda_C)$ is calculated for a series of crystalline solids, liquids, and solutions. This is a suitable means of characterizing the series of interference colours exhibited by optically active substances in polarized light. By the aid of the ratio R it is also shown that the interference colours observed in crystals with ordinary double refraction are almost identical with those given by optically active substances. Further, the colours of an optically active wedge are practically the same as those obtained in a plane-parallel plate of the same substance when the analyser is rotated. From the dispersion curves of specific rotation, values of R have been calculated in good agreement with experimental values. The corresponding value V for a magnetic-optically active crystalline substance is not in general the same as the R value. The fact that the Wiedemann law is still further departed from in the case of liquids and magnetic-optically active solutions is therefore probably to be attributed to other reasons than the presence of optically-active impurities.

F. A. B.

GYSIN (M.). *Sur l'emploi des signes + et – devant les coordonnées des pôles des éléments cristallographiques dans la méthode de Fédorow.* Bull. Soc. Franç. Min., 1928, vol. 51, pp. 254–273, 6 figs.

The angular distances between the poles of the three principal optical directions, α , β , and γ , and the poles of the crystallographic axes of a mineral are deduced from stereographic projection in the usual manner. In transferring these measurements to a stereographic projection normal to β , angular distances less than 90° are plotted directly as positive values and the supplements of angles greater than 90° are plotted as negative values. This convention preserves the original relative position of poles, and in the case of the feldspars renders the comparison with Duparc and Reinhard's diagram more direct. The method is fully illustrated in its application to an un-twinned plagioclase and an anorthite made up of several twinned individuals. [Cf. M.A. 3–515–521.]

F. A. B.

BRASSEUR (H.). *Discussion de la formule de Verdet donnant l'intensité d'un faisceau lumineux qui traverse deux lames cristallines superposées entre nicols croisés et application à la mesure des retards des lames cristallines.* Zeits. Krist., 1929, vol. 72, pp. 143-158, 1 fig.

Formulae are obtained for the maxima and minima of the intensity of monochromatic light after transmission through two crossed nicols, a fixed crystalline plate, and another crystalline plate of variable orientation. In the applications the axes of the fixed plate bisect the angles between the planes of the nicols, and the plate whose phase-difference is required is rotated. H. H.

BRASSEUR (H.). *Sur la mesure du dichroïsme d'une lame dont on connaît le retard.* Zeits. Krist., 1929, vol. 72, pp. 159-176, 5 figs.

The dichroism of a crystalline plate is determined by observations of the maximum and minimum intensities of the light transmitted through this plate, two crossed nicols, and a second fixed non-dichroic plate whose axes bisect the angle between the nicol-planes, when the first plate is rotated. The method is illustrated by a determination of the dichroism of a specimen of staurolite from St. Gotthard. H. H.

RINNE (Friedrich) & RÖSCH (Siegfried). *Ueber die spektrale Differenzierung des Pleochroismus von Biotit.* Neues Jahrb. Min., Abt. A., 1928, vol. 57, pp. 823-840, 11 figs.

Two instruments are described for measuring the ratio of the light transmitted to that incident on a crystal plate for different wavelengths. It is shown graphically how this ratio varies for the principal directions in a crystal of biotite. Thence the spectral distribution of the transmitted light is calculated for different thicknesses. Considering in addition physiological factors, the authors arrive at a quantitative measure of the strength of dichroism in monochromatic and white light. F. A. B.

DIMITRIEVITCH (B.). *Sur un cas de pseudopolychroïsme de la calcite.* Bull. Soc. Franç. Min., 1927, vol. 50, pp. 501-504, 1 pl.

Calcite replacing phenocrysts of felspar in the intrusive rocks of Mount Avala (Serbia) clearly shows this property owing to the presence of minute isotropic inclusions, not identified. F. A. B.

GAMBARIAN (Pierre). *Un cas de pseudopolychroïsme et pseudobiréfringence*. Bull. Soc. Franç. Min., 1928, vol. 51, pp. 173-176.

If a piece of aluminium be scraped under bromoform a black fibrous layer forms where the protective coating of aluminium has been removed. This coating appears to be birefringent and polychroic, but on immersion in a liquid these properties are weakened or disappear entirely. It is thought that the phenomenon is analogous to the behaviour of thin cleavage cracks in blende and fluorspar and even cracks in glass. The thin layer of air is sufficient to account for the phenomena observed. X-ray photographs do not reveal the customary diffraction effects of crystalline substances. F. A. B.

KEELEY (Frank J.). *Notes on absorption spectra of certain minerals*. Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 170-171, 1 pl.

The several minerals containing cerium can be distinguished by the modifications of the broad absorption band in the yellow. Characteristic absorption spectra are given by ruby and alexandrite. In ruby, the narrow bright line (0.69μ) between two absorption bands appears to be due to fluorescence. L. J. S.

WHERRY (Edgar T.). *Mineral determination by absorption spectra*. Amer. Min., 1929, vol. 14, pp. 299-308, 323-328.

Repetition of an earlier paper [M.A. 1-230] with a different arrangement of the tables, in which are also tabulated the results of other observers. L. J. S.

EMMONS (R. C.). *The double variation method of refractive index determination*. (Second paper.) Amer. Min., 1929, vol. 14, pp. 414-426, 6 figs.

Further details of the immersion method for determining refractive indices with variations both of wave-length and of temperature [M.A. 4-58]. Two forms of apparatus are figured. Values are tabulated and plotted of the refractive indices of fourteen liquids for three wave-lengths (D, C, F) at temperatures 10° , 25° , and 50°C . L. J. S.

EMMONS (R. C.). *A modified universal stage*. Amer. Min., 1929, vol. 14, pp. 441-461, 1 pl., 5 text-figs.

Another circle with horizontal E.-W. axis is added to the Fedorov stage, making in all six axes of rotation, viz. three vertical axes, one N.-S., and two E.-W. When a crystal grain has been oriented with

one vibration-direction parallel to the axis of the microscope, this modified stage enables either of the other vibration-directions to be brought into the same position without any graphical constructions and with a quickness of working dear to American petrographers. With a special heating arrangement on the stage, this apparatus is used for the determination of the three indices of refraction by the immersion method with both temperature and wave-length as variables [preceding abstract]. Four graphs are given. L. J. S.

EMMONS (R. C.). *A set of thirty immersion media*. Amer. Min., 1929, vol. 14, pp. 482-483.

A series of liquids, for refractive index determinations, ranging from trimethylene chloride (n_D 1.446 at 24° C.) to methylene iodide (1.738) is listed, with their boiling-points and temperature coefficients. Single compounds or mixtures of compounds with nearly the same boiling-point have been selected, so that there will be little change in the refractive index on evaporation. L. J. S.

BARTH (Tom.). *Some new immersion melts of high refraction*. Amer. Min., 1929, vol. 14, pp. 358-361. 3 figs.

Mixed crystals of TiCl , TiBr , TiI , melting-points 426-450° C., give transparent isotropic media with n 2.4-2.8 (Na). L. J. S.

ROTHSCHILD (Siegfried). *Über die Phosphoreszenz von Flußspat und Orthoklas*. Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 243-255, 1 pl.

An interesting historical review is given of the literature (from 1604) on phosphorescence and fluorescence. Comparative experiments were made in order to test the view that during thermoluminescence the material is merely giving out previously stored-up light energy. Fluorite collected underground (1) was compared with specimens that had been previously exposed to light, either long ago (2) or just before the experiment (3). Gradually warmed up in a paraffin bath, no. 1 is the first to glow and no. 3 glows only at a higher temperature. On a photographic plate for 96 hours, no. 1 had no effect, and no. 3 was more active than no. 2. A certain temperature is necessary to liberate the latent energy (perhaps due to radioactivity in the earth) of no. 1. Orthoclase from pegmatite and from granite near Heidelberg and from the Riesengebirge glow when warmed in paraffin, irradiated material responding more readily. L. J. S.

ENGLE (Dorothy G.) & HOPKINS (B. S.). *Studies in luminescence*. Journ. Opt. Soc. Amer. & Rev. Sci. Instruments, 1926, vol. 11, pp. 599-615, 9 figs.

Intensity of luminescence, especially of fluorescence excited by cathode rays, was measured with a photoelectric caesium cell. In a large number of preparations it was found that the colour and intensity of fluorescence is influenced by the nature and amount of the sensitizing agent, the temperature and time of fusion in making the preparation, intimacy of mixing (best from solutions), nature of the exciting agent, and atomic weight of the base used. Zinc metasilicate (ZnSiO_3) is more active than zinc orthosilicate (Zn_2SiO_4), and good sensitizers are Tl, Nd, CeO_2 , Nb, Mo. With zinc sulphide the best sensitizing agents are Mg, Cu, Mn; and with calcium metaphosphate ($\text{Ca P}_2\text{O}_6$), Mo, Nd, Er. In general, luminescence increases with decreasing amounts of the sensitizing agent (about 0.05 %), but the effect is periodic, and the presence of a trace of iron has a deleterious effect.

L. J. S.

LONGCHAMBON (Henri). *Recherches expérimentales sur les phénomènes de triboluminescence et de cristalloluminescence*. Bull. Soc. Franç. Min., 1925, vol. 48, pp. 130-214, 1 pl., 7 text-figs.

After an historical survey of the subject, experimental details are given of the photographing of the spectra emitted by many substances which show the property of triboluminescence or cristalloluminescence. The spectra for the former cases are identical with that of the line spectrum of nitrogen; triboluminescence is due to an electric discharge produced by the fracture of crystals and the discharge renders the surrounding gas luminescent. With fluorescent or phosphorescent substances the property may be complicated by fluorescence or phosphorescence excited by the discharge. With hard substances the effect may be still further complicated by a heating of the particles removed by friction to incandescence. True triboluminescence cannot be reproduced in simple crystalline bodies or in amorphous substances. However, its production does not depend on the lack of centre of symmetry, but the pulling apart of planes carrying opposite charges, for example, the octahedral planes of rock-salt. In the case of crystals lacking a centre of symmetry the phenomenon of triboluminescence does not take place when the crystal is broken along a cleavage-plane unless that plane is perpendicular to an axis of piezo-electricity. A certain number of

substances showing crystalloluminescence are really triboluminescent, change of temperature breaking up the crystals. Other cases, however, are distinct; rock-salt, for instance, gives a totally different spectrum. So far the origin of this effect is not clear. F. A. B.

NELSON (D. M.). *Photographic spectra of tribo-luminescence*. Journ. Opt. Soc. Amer. & Rev. Sci. Instruments, 1926, vol. 12, pp. 207-215, 1 pl., 2 text-figs.

Zinc-blende from the Horn Silver mine, Frisco, Beaver Co., Utah, fashioned as a grindstone and revolving (2,000 per minute) against a carborundum or wire brush gives out sufficient orange-yellow light for the spectrum to be photographed. This shows a narrow band from 6,100 to 5,700 with maximum at 5,900 Å. Artificial triboluminescent zinc sulphide gives a broader band extending into the green. Fluorite (chlorophane) gives a maximum at 5,750 Å. Other triboluminescent minerals are dolomite, tremolite, pectolite, talc, willemite, and wollastonite. A brief summary is given of the literature on triboluminescence. L. J. S.

GORDON (Samuel G.). *The exhibit illustrating fluorescence at the Academy of Natural Sciences of Philadelphia*. Amer. Min., 1929, vol. 14, pp. 362-368, 2 figs.

Fluorescence of minerals in ultra-violet rays is shown with an automatic arc-lamp, the carbons of which contain a core of iron, nickel, aluminium, and silicon. The most striking effect, an intense lemon-yellow fluorescence, is given by scapolite from Grenville, Canada. Sodalite from Tunugdliarfik, Greenland, gives a cadmium-yellow. [Cf. M.A. 4-66.] L. J. S.

Physical Properties of Crystals.

BECHTEREW (P.). *Zur Systematik der Elastizitätskonstanten anisotroper Stoffe*. Zeits. Krist., 1929, vol. 71, pp. 274-276.

The author gives in simpler form the justification for his grouping of the twenty-one elastic constants of a crystalline medium, which he had proposed earlier [M.A. 3-324]. H. H.

EITEL (Wilhelm). *Physikalisch-chemische Grundlagen der Schleifmittelkunde*. Zeitschrift des Vereines Deutscher Ingenieure, 1928, vol. 72, pp. 1155-1157, 5 figs.

The importance of the physical, chemical, and crystallographic properties of abrasive materials is illustrated by a brief résumé of

the properties of corundum and carborundum. The hardness, cleavage, brittleness, &c., are closely connected with the crystal-structure.

F. A. B.

BUERGER (Martin J.). *Translation-gliding in crystals*. Thesis for degree of D.Ph., 1929, abstract published in Abstracts of Scientific and Technical Publications from the Massachusetts Institute of Technology, Cambridge, Mass., 1929, no. 4, pp. 66-67.

A résumé of the scattered literature and an extension of previous work [M.A. 4-64]. Eleven types of gliding symmetry are distinguished. Correlating the gliding elements with the crystal-structure in a number of substances, it is found that the translation direction depends on the alinement of closest ions of like charge. In the alkali halides translation on (001) takes place in the directions $[\bar{1}\bar{1}0]$ and $[\bar{1}10]$, and the ease of gliding increases from fluoride to iodide and from the sodium salt to the potassium salt.

L. J. S.

TAMMANN (G.) & SALGE (W.). *Der Einfluß des Druckes auf die Reibung beim Gleiten längs der Gleitebenen von Kristallen*. Neues Jahrb. Min., Abt. A, 1928, vol. 57, pp. 117-130, 6 figs.

The influence of a pressure at right angles to the glide-planes of ice and of halite on the force required to produce gliding at various temperatures has been investigated. The necessary force is found to diminish with the pressure according to an exponential law of the form $\log f = \log f_0 + kp$.

M. H. H.

COHN (Willi M.). *Ueber Wärmeleitfähigkeit, Wärmeausdehnung, spezifische Wärme und einige andere thermische Eigenschaften von Mineralien und keramischen Massen*. Berichte der Deutschen Keramischen Gesellschaft, 1928, vol. 9, pp. 239-299, 27 figs.

The most important methods of determining thermal conductivity, expansion, specific heat, heats of reaction, &c., are critically described from the point of view of ceramic materials. Tabulated and graphical data are given for various silicates and materials used in the ceramic industry. Most of the data are based on laboratory work; results obtained from small samples in relatively short times will differ somewhat from data that may in the future be compiled from industrial experiments where large batches are used and the time taken to reach thermal equilibrium is necessarily large.

F. A. B.

MÜGGE (O.). *Über die Kohäsionsverhältnisse einiger künstlichen Kristalle und über die Bedeutung der Gleitungen für gewisse Zustandsänderungen.* Zeits. Krist., 1929, vol. 71, pp. 64-80, 9 figs.

Experiments were made on the percussion-figures and shearing of orthorhombic diamine zinc chloride $[(\text{NH}_3)_2.\text{ZnCl}_2]$; on the crystal form, optical properties, and shearing of triclinic amidoguanidine nitrate $[\text{CH}_6\text{N}_4.\text{HNO}_3]$; and also on the optical properties and shearing of the monoclinic butyrates of calcium, strontium, and barium.

H. H.

KAYE (G. W. C.) & HIGGINS (W. F.). *The thermal conductivity of a single crystal of bismuth in a transverse magnetic field.* Phil. Mag., 1929, ser. 7, vol. 8, pp. 1056-1059, 2 figs.

The fact that the thermal conductivity of bismuth in crystalline aggregate is decreased in the presence of a magnetic field has been known since 1887. Measurements are now made on oriented plates cut parallel and perpendicular to the trigonal axis. At 27°C . in a field of 11,000 gauss the greater conductivity in the direction of the trigonal axis shows a decrease of 16 %; and the lesser conductivity perpendicular thereto shows a decrease of 7.3 or 4.9 %, according as the magnetic field is parallel or perpendicular to the trigonal axis.

L. J. S.

WELO (Lars A.) & BAUDISCH (Oskar). *The two-stage transformation of magnetite into hematite.* Phil. Mag., 1925, ser. 6, vol. 50, pp. 339-408, 4 figs.

Magnetite was prepared artificially as a micro-crystalline powder by adding a mixed solution of ferric and ferrous sulphates to a boiling solution of sodium hydroxide. Heated at 220°C . in a stream of oxygen this product suddenly changes from black to dark-red in colour, and it then consists entirely of Fe_2O_3 without any trace of FeO . This ferric oxide is still magnetic, the maximum permeability (μ 3.39) being even higher than that of the original magnetite (μ 2.93), and it shows the same X-ray diffraction patterns as magnetite. When it is heated to 550°C . the crystalline structure changes over to that of haematite and the magnetic properties are lost. The unit cube of magnetite contains eight molecules of Fe_3O_4 and in the change from $\text{Fe}_{24}\text{O}_{32}$ to $\text{Fe}_{24}\text{O}_{36}$ the four extra oxygen atoms are perhaps accommodated at the centres of the four tetrahedral groups of Fe''' in the magnetite structure. When protected from

oxidation, Fe_3O_4 can be heated up to 800°C . without permanent loss of its magnetic properties. [Cf. R. B. Sosman and E. Posnjak, M.A. 3-217, M.A. 4-59-60.] L. J. S.

TWENHOFEL (Lillian H.). *Changes in the oxidation of iron in magnetite*. Econ. Geol., 1927, vol. 22, pp. 180-188.

Repeats the experiments of Welo and Baudisch (preceding abstract) and finds that with oxidation the change from magnetite to magnetic ferric oxide¹ is a gradual one, depending on the temperature, length of time, and condition of the magnetite (whether prepared by different methods or natural). If the extra oxygen atoms find a place in the centre of the tetrahedral groups of Fe''' , the intensity of the lines in the X-ray pattern should show some difference. It is suggested that these oxygen atoms are irregularly spaced. Remarks on this paper by Geoffrey GILBERT (ibid., pp. 309-310), W. H. NEWHOUSE and W. H. CALLAHAN² (pp. 629-632), and Percy A. WAGNER (pp. 845-846), mentioning natural occurrences of magnetic brown oxidized magnetite, for which P. A. Wagner suggests the name 'maghemite'. L. J. S.

NEWHOUSE (W. H.). *The identity and genesis of lodestone magnetite*, Econ. Geol., 1929, vol. 24, pp. 62-67.

The relatively few specimens of magnetite that are magnetic with polarity show, when examined under the microscope on polished surfaces, in nearly all cases signs of oxidation; and it is believed that lodestone is mainly the magnetic ferric oxide (which possesses a higher residual magnetism than magnetite). The polarity has probably been induced by a concentration of the earth's magnetic field at the ends of ore-bodies. L. J. S.

JACKSON (W.). *The effect of ultra-violet and X-rays on the steady current characteristics of crystal detectors*. Phil. Mag., 1929, ser. 7, vol. 7, pp. 866-873, 7 figs.

The characteristic curves of crystal detectors for Herzian waves are modified by exposure to ultra-violet and X-rays. In most cases exposure to X-rays completely destroys the rectifying properties.

F. A. B.

¹ Magnetic ferric oxide was first noticed by J. Robbins, 'Magnetic peroxide of iron'. Chem. News, London, 1859, vol. 1, pp. 11, 119.

² Under the title 'Two kinds of magnetite?' fresh 'bluish' and oxidized 'brownish' magnetites are distinguished.

HURST (H. E.). *The suspension of sand in water.* Proc. Roy. Soc. London, Ser. A, 1929, vol. 124, pp. 196-201.

It is found that particles in suspension due to turbulent motion in a liquid behave like gas molecules. Problems arising out of the suspension of solid particles in streams may be aided by this analogy.

F. A. B.

EMELÉUS (K. G.) & BECK (Jean W.). *On single crystal cathodes.* Phil. Mag., 1929, ser. 7, vol. 8, pp. 121-125, 1 fig.

A crystal of pyrite was found to behave like an ordinary piece of polycrystalline metal in the glow-discharge when used as a cathode. The gases used were argon, neon, nitrogen, oxygen, and air. From the value of the normal cathode-fall in potential in these gases the work function of pyrite for electrons is calculated to be 4.8 volts.

F. A. B.

BOND (W. N.). *Certain molecular lengths measured by an optical lever.* Phil. Mag., 1929, ser. 7, vol. 7, pp. 1163-1182, 4 figs.

An optical lever is devised to measure changes in the thickness of a sheet of muscovite correct to 1.5×10^{-8} cm. The observed changes in thickness of the mica show a periodicity corresponding to the length of the cell-edge of muscovite. Similarly, steel yields a periodicity corresponding to the cell-edge of cementite. Experiments with gypsum, however, revealed no obvious periodicity. The needle-tip of the lever is assumed to rupture a certain number of the surface-layers, these layers flowing radially outwards until the needle rests upon the first intact layer. The return flow, on withdrawing the needle-tip, is attributed either to surface-tension or to cohesive forces.

F. A. B.

Rock-forming Minerals and Petrology.

TOMITA (Tôru). *The Esterel twin of porphyritic quartz in alkali-liparite from Dôgo, Oki.* Japanese Journ. Geol. Geogr., 1929, vol. 6, Abstracts p. (10) [from Journ. Geol. Soc. Tokyo, 1928, vol. 35, pp. 419-429, Japanese].

A quartz phenocryst examined by the universal-stage method was found to be twinned according to the Esterel law, a type of twinning not previously recorded for Japanese quartz. [See Min. Mag. 21-369.]

L. J. S.

ODER (Charles R. L.). *Occurrence of doubly terminated quartz crystals in sandstone in the Shenandoah valley, Virginia.* Amer. Min., 1929, vol. 14, pp. 382-384, 3 figs.

Small (0.5-1.2 mm.) doubly-terminated crystals of quartz were found embedded in limonite in a ferruginous sandstone replacing dolomite.

L. J. S.

ALLING (Harold L.). *The indices of refraction of the plagioclase feldspars.* Journ. Geol. Chicago, 1929, vol. 37, pp. 462-482, 4 figs.

A tabulation is given of the data on which are based the curves, given in various text-books, plotting the refractive indices against the chemical composition of the plagioclase series. Many of the chemical analyses are old ones and the optical determinations have not always been made on the material actually analysed. Attempts to correlate the effect of the potash content were unsuccessful. The author is disheartened.

L. J. S.

PARDILLO (F.) & CANDEL (R.). *La anortoclasa del barranco de San Lorenzo (Gran Canaria) y las macles de los feldespatos triclinicos.* Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 198-207, 5 figs.

Crystals (5-6 × 2-3 mm.) of anorthoclase from weathered trachyte in the San Lorenzo ravine are usually elongated along [100] with a square cross-section, or sometimes tabular on (010). They show the forms $cbmfmzyenpo$. Sp. gr. 2.59 (2.57-2.61). Extinction on (010) to the edge [100] + 6°, $\gamma \perp (010)$, β 1.544, 2V 67° about. Twin-laws are the albite, Roc-Tourné, pseudo-Manebach (albite-Esterel), and heterotwins on $m(110)$, $M(1\bar{1}0)$, $f(130)$, and $z(1\bar{3}0)$. Twins of plagioclase are discussed and twenty-six laws distinguished, for which tables of calculated angles are given.

L. J. S.

TOMITA (Tôru). *Hastingsite in soda granite porphyry of Mori near Lake Kizaki, Province Shinano.* Japanese Journ. Geol. Geogr., 1929, vol. 6, Abstracts p. (10) [from Journ. Geol. Soc. Tokyo, 1928, vol. 35, pp. 430-439, Japanese].

The hastingsite, together with biotite, forms spherulitic aggregates in the soda-granite-porphyry. Refractive indices in cleavage flakes n_1 1.6927, n_2 1.7008 (Na); $\beta = b$, $\gamma:c = 30-32^\circ$, 2E 20° , 2V 12° .

L. J. S.

TSCHIRWINSKY (Peter) [= CHIRVINSKY (P. N.)]. *Zur Kenntnis der Antiperthite*. Zeits. Krist., 1929, vol. 71, pp. 136-140, 2 figs.

A description of a specimen of antiperthite from the biotite-hornblende-syenite of Marblehead, Mass., U.S.A., and of another from the Ilmen Mts., Ural. H. H.

HARAGUCHI (Kuma). *Sodalite in nepheline-syenite of Fukushima, Korea*. Japanese Journ. Geol. Geogr., 1929, vol. 6, Abstracts p. (11) [from Chikyu (The Globe), 1928, vol. 10, pp. 262-265, Japanese].

The nepheline-syenite contains sky-blue sodalite, nepheline, lepidomelane, orthoclase, microcline, albite, cancrinite, melanite, zircon, fluorite, magnetite, &c. The sodalite has $n_{1.48271}$ (Na), sp. gr. 2.298, H. 5½. Analysis, SiO₂ 37.42, Al₂O₃ 3.14, FeO trace, MgO 0.39, CaO 0.93, Na₂O 21.68, K₂O 0.13, Cl 7.12, H₂O + 2.46, H₂O - 0.45 = 100.12, agrees with the formula Na₄Al₃Si₃O₁₂Cl. The sodalite is thought to be of pneumatolytic origin. L. J. S.

HARAGUCHI (Kuma). *Phenocrysts of volcanic rocks and Tertiary fossils in Quelpart (Saishu) Island*. Japanese Journ. Geol. Geogr., 1929, vol. 6, Abstracts p. (11) [from Chikyu (The Globe), 1928, vol. 10, pp. 350-356, Japanese].

Black crystals (5 mm.) of augite from the crater of Mt. Hallasan, the chief volcano on Quelpart Island, show the forms $abms c$; α 1.6959, β 1.7019, γ 1.7140, $2V$ 59° 11', $c : \gamma = 44^\circ$; sp. gr. 3.228; analysis gave SiO₂ 49.63, TiO₂ 1.08, Al₂O₃ 14.59, Fe₂O₃ 1.14, FeO 6.17, MnO 0.21, MgO 6.37, CaO 18.48, Na₂O 0.57, K₂O 0.58, P₂O₅ 0.18, SO₃ 0.12, H₂O 0.88. Brown transparent crystals (2 mm.) of olivine from the same source show the forms $msbk$; β 1.676, $2V$ 83°. Labradorite has sp. gr. 2.712, α 1.5571, β 1.5602, γ 1.5650, $2V$ 76°, ac 86° 5'. L. J. S.

TILLEY (C. E.), with an analysis by H. F. HARWOOD. *On melilite as a product of interaction of limestone and basaltic liquid*. Geol. Mag. London, 1929, vol. 66, pp. 347-353, 3 figs.

The hybrid rock formed by the assimilation of chalk by dolerite at Scawt Hill, Co. Antrim, is composed of titanaugite and melilite, with nepheline, aegirine, &c. The melilite forms brown to honey-yellow plates up to one inch across: ω 1.647, ϵ 1.636 (Na). Analysis gave SiO₂ 37.84, TiO₂ 0.66, Al₂O₃ 12.89, Fe₂O₃ 1.13, FeO 5.66, MgO 3.12, CaO 33.19, Na₂O 3.93, K₂O 0.25, H₂O + 1.59, H₂O - 0.07 = 100.33, which is expressed as 15Ge, 47Åk, 38Sa. In the melilites the refrac-

tive indices and birefringence increase with the percentage of iron, which is high in this mineral. With the introduction of lime in the magma, the melilite has developed at the expense largely of the anorthite and diopside molecules.

L. J. S.

BRAMLETTE (M. N.). *Natural etching of detrital garnet.* Amer. Min., 1929, vol. 14, pp. 336-337, 2 figs.

Grains of garnet in sandstones frequently show surface markings suggestive of cleavage. But the grains when crushed display no cleavage. The effect is produced by etching, and it can be imitated by the action of hydrofluoric acid.

L. J. S.

READ (H. H.). *On the occurrence of iron-rich cordierite in Aberdeenshire.* Geol. Mag., 1929, vol. 66, pp. 547-552.

A new analysis of the cordierite-spinel-hornfels from Gallowhill Brae, Arnage, Aberdeenshire [M.A. 2-537], supported by an analysis of cordierite-plagioclase residue separated from the rock, shows that the cordierite is one very rich in iron. It is the only cordierite known in which the $\text{FeO}:\text{MgO}$ ratio exceeds unity: it may be as high as 1.6. P. Eskola and others have thought that the series of mixtures of corresponding magnesium and ferrous compounds in cordierite is not continuous, but that the maximum molecular quantity of the ferrous compound is approximately 50 %. This appears to be disproved, and, if so, Eskola's interpretation of the application of the phase rule to the conditions of formation of almandine and cordierite becomes invalid. The optical properties of the cordierite are not given either in this or in the earlier paper.

W. C. S.

GABRIEL (A.) & COX (E. P.). *A staining method for the quantitative determination of certain rock minerals.* Amer. Min., 1929, vol. 14, pp. 290-292, 2 figs.

The crushed rock or micro-section is exposed to hydrofluoric acid fumes in a leaden box, and then treated with a solution of sodium cobaltinitrite. A yellow precipitate of potassium cobaltinitrite is thereby formed on the potash-felspar, while quartz remains transparent, and plagioclase-felspar white and opaque.

L. J. S.

SLAWSON (Chester B.). *The quantitative optical determination of sodium and potassium chlorides.* Amer. Min., 1929, vol. 14, pp. 293-298, 3 figs.

For the estimation of small amounts of potassium and sodium in rock analyses a method based on the determination of the refractive

index of the fused chlorides is suggested. Rather than forming a continuous series of mixed crystals it is found that there is a number (10 or 12) of double salts, which range in refractive index from 1.490 for KCl to 1.544 for NaCl. On cooling, the melt breaks down into two of these double salts, the refractive indices and relative amounts of which can be quickly judged.

L. J. S.

BELĬANKIN (D.) [Белянкин (Д. С.) = BELYANKIN (D. S.)]. *On the term "rock" and on petrographical classification and nomenclature.*

Travaux du Musée Minéralogique près l'Académie des Sciences de l'URRS, 1929, vol. 3, pp. 12-24.

Rock is defined as 'a mineral body, homogeneous in matter and structure' or 'a mineral aggregate, or else a mineral body of a certain constant composition and structure'. The suitability of this definition is discussed, and then classification and nomenclature are briefly considered. Classification of rocks, it is held, must be based on the quantitative mineralogical principle. The American method based on the chemical analyses is thought to be unsatisfactory and that of F. Levinson-Lessing simpler and more attractive. On the subject of nomenclature the author regards the practice of basing rock-names on place-names as entirely unsuitable. He considers that scientific petrographic nomenclature should be based on the material mineralogical composition of the rocks; and he throws out a suggestion to form names from the first syllables or letters of the constituent minerals, supplementing these by prefixes, letters, or simple formulae to indicate quantitative differences where necessary. Examples are given of the new names which might be devised on this plan for the family of felspar-free, nepheline-, and sodalite-rocks, ijolite, urtite, &c. For example, 'aegineite' for aegirine-nepheline-rocks.

W. C. S.

Ross (Clarence S.). *Physico-chemical factors controlling magmatic differentiation and vein formation.* Econ. Geol., 1928, vol. 23, pp. 864-886.

Ordinary molten rock-magmas are not fitted to penetrate rock-masses and develop veins, having too low a specific heat, and in general too great viscosity to penetrate small open spaces and capillaries; and it does not appear probable that gases or vapours could introduce silicates, quartz, carbonates, and sulphides effectively. The duty of vein-formation must be undertaken by concentrated or

dilute hydrothermal solutions. The presence of dissolved salts obviates the necessity of considering critical temperature phenomena. A small proportion of alkali will suffice to carry considerable quantities of silica and enable their crystallization as coarse-grained quartz. The solutions are probably produced as mother-liquors in the crystallization of a molten magma, and the pressure necessary to keep them liquid and to force them through the capillary spaces of a rock-mass is naturally produced when the less volatile constituents of the original magma crystallize out, leaving a mother-liquor growing progressively richer in water and other volatile constituents. There will be a tendency for alkalis to become concentrated in this solution, and there will also be material redissolved from the first-deposited crystals and from other rocks traversed by the solution. This interpretation is supported by the fact that crystallized silica deposits are usually quartz, and must have been deposited below 870°C. , and probably below 573°C.

M. H. H.

ERDMANNSDÖRFFER (O. H.). *Über ein sibirisches Nephelingestein.*

Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 85–88.

A rock specimen from the Bjerez river, Achinsk district, Yeniseisk, shows numerous large (12 mm.) phenocrysts of reddish nepheline, and smaller phenocrysts of pyroxene (fringed with aegirine), analcime, and andesine, in a dark-grey fine-grained groundmass of pyroxene, biotite, andesine, orthoclase, and iron-ores. Analysis by Nieland gave SiO_2 47.25, TiO_2 0.56, Al_2O_3 23.66, Fe_2O_3 4.79, FeO 3.28, MnO 0.20, MgO 0.80, CaO 4.30, Na_2O 8.94, K_2O 2.60, P_2O_5 n.d., $\text{H}_2\text{O} + 3.63$, $\text{H}_2\text{O} - 0.55 = 100.56$; sp. gr. 2.659. This falls between tönshbergite (trachyandesite) and urtite, and the rock is named bjerezite.

L. J. S.

HERON (A. M.). *The soda-bearing rocks of Kishengarh, Rajputana.*

Rec. Geol. Survey India, 1924, vol. 56, pp. 179–197, 12 pls.

The nepheline-syenites, as several masses intrusive into schists, are coarse-grained and usually granitoid, but sometimes foliated and marked by bands richer in ferromagnesian minerals and a glomeroplastic structure due to flow. Analysis I of the normal rock and II of the dark banded syenite. The constituent minerals are clear nepheline (anal. III), various feldspars, sodalite (fine blue, anal. IV;

or colourless, which sometimes shows a pink colour quickly bleached by light), amphibole (anal. V, with extinction-angle $c:\gamma$ up to 36° , usually $24-27^\circ$, α 1.631, β 1.649, γ 1.659, sp. gr. 3.126, pleochroism α greyish-yellow, β and γ blue-green), pyroxene, biotite, garnets, and some primary calcite and cancrinite. In the associated pegmatites these minerals are sometimes developed on a large scale. A cancrinite-calcite contact-rock contains tremolite and a pink mineral (anal. VI, sp. gr. 3.30, n 1.700 or 1.711) which is referred to thulite. (Analysis V by W. A. K. Christie, the others by B. C. Gupta.)

	SiO ₂ .	Al ₂ O ₃ .	Fe ₂ O ₃ .	MgO.	CaO.	Na ₂ O.	K ₂ O.	H ₂ O.	Cl.	Total (less O).
I.	55.32	23.78	4.73	1.07	1.18	8.46	4.50	—	0.64	99.54
II.	54.52	24.32	6.62	0.43	1.71	10.62	1.60	—	0.99	100.59
III.	39.04	35.36	trace	0.40	nil	18.00	4.33	—	3.91	100.19
IV.	38.055	31.30	trace	—	0.001	24.77	—	0.82	7.18	100.51 ¹
V.	52.21	2.72	2.71	11.24	10.89	1.04	0.37	0.78	—	99.94 ¹
VI.	34.92	33.17	5.99	0.49	24.43	0.14	—	—	—	100.0 ¹

¹ IV, including loss on ignition 0.82, SO₃ trace. V, FeO 17.19, H₂O above 107° 0.61, TiO₂ trace, MnO 0.59, F 0.35. VI, MnO 0.86.

L. J. S.

WOLFF (John E.). *Mount Monadnock, Vermont—a syenite hill.*

Journ. Geol. Chicago, 1929, vol. 37, pp. 1-16, 4 figs.

A concise account of the topography and geology of Mt. Monadnock, which belongs to a series of intrusions of alkali igneous rocks—the Novanglian petrographic province—an extension of the province developed in the Monteregian Hills of Quebec. The rocks are 'syenite'—a quartz-nordmarkite, transitional to granite [metaluminous albite-granite in the classification of Shand], and an essexite, with dikes of quartz-bostonite, aplite, and camptonite. The intrusion commenced with essexite and ended with the camptonite dikes. Chemical analyses and descriptions are given. The optical and chemical properties of the amphibole have been studied in detail: SiO₂ 38.72, TiO₂ 5.03, Al₂O₃ 10.94, Fe₂O₃ 4.33, FeO 26.03, MnO 0.88, MgO 2.19, CaO 8.55, Na₂O 1.39, K₂O 1.25, H₂O + 1.22 = 100.53; sp. gr. 3.422; α = 1.693, β = 1.711, γ = 1.713; $c:\gamma$ = $20^\circ-21^\circ$; 2V measured and reduced $43\frac{1}{2}^\circ$, negative; pleochroism, α light yellow, β deep olive-green, γ deep grass-green. This amphibole belongs to the 'ferrohastingsite' division of M. Billings's classification [M.A. 4-39]. Its similarity with other amphiboles from the alkali intrusives of Quebec and New England is shown by tabulated analyses and optical data.

W. C. S.

ANGEL (Franz). *Stubachit und Stubachitserpentin vom Ganoz (bei Kals in Osttirol). Ein Beitrag zum chemischen und physiographischen Studium von Serpentinmineralien.* Zeits. Krist., 1929, vol. 72, pp. 1-41, 1 pl., 7 text-figs.

Stubachite, a rock consisting of olivine, pyroxene, and antigorite was described by E. Weinschenk [Min. Mag. 11-116] as an igneous rock in which he considered the antigorite to be an original constituent. A similar rock, now described in detail from Ganoz, is regarded as a partly altered olivine-diallage-rock, which by further alteration gives a stubachite-serpentine. Several varieties of serpentine in these rocks are distinguished and tabulated (p. 13).

L. J. S.

MACHATSCHKI (Felix). *Enstatit-Hornblendit* [i.e. Hypersthen-Hornblendit] *von Grönland.* Centr. Min., Abt. A, 1927, pp. 172-175, 1 fig.

A loose, coarse-grained rock from Upernivik island, north of Disko on the west coast of Greenland, consists of black hornblende with about 20 % of hypersthene, and very little olivine and ores. The hornblende has extinction-angle 17° and pleochroism α clear yellowish-green, β greenish-black, γ dark olive-green; and the hypersthene α clear brownish-red, β pale yellow, γ pale bluish-green. Analysis gave SiO_2 46.18, TiO_2 0.84, Al_2O_3 8.23, Fe_2O_3 3.88, Cr_2O_3 0.02, FeO 8.78, MgO 19.69, CaO 8.81, Na_2O 1.64, K_2O 0.25, P_2O_5 0.07, H_2O ($+110^\circ$) 1.26 = 99.65. A calculation of the mineral composition from this analysis is not possible with the usual formula of hornblende. The rock is intermediate between hornblendite and bahiaite (hypersthene) and it is named greenlandite (Grönlandit) [a name previously applied to two distinct minerals.]

L. J. S.

DUPARC (L.) & MOLLY (E.). *Sur la présence de la kényite sur le plateau abyssin.* Compt. Rend. Soc. Phys. Hist. Nat. Genève, 1928, vol. 45, pp. 22-23.

A dike in the massif of Kontchi near Quéla Bilo, on the Nekanti-Addis Ababa road proves on analysis to have a chemical composition very close to that of the kényite of Mt. Kenya. The rock is porphyritic with a black glassy groundmass. Very minute grains in the groundmass are thought to be an alkali-pyroxene. Phenocrysts consist of abundant anorthoclase, some small magnetites, and very rare brownish amphibole. The characters of the anorthoclase were deter-

mined by the Fedorov method: extinction on (010) + 7° with reference to [001,010]; negative; $\gamma - \alpha = 0.077$, $\gamma - \beta = 0.010$, $\beta - \alpha = 0.067$; 2V, measured 51°, calculated 42°. W. C. S.

DUPARC (L.) & MOLLY (E.). *Sur la tokéite, une nouvelle roche d'Abysinie*. Compt. Rend. Soc. Phys. Hist. Nat. Genève, 1928, vol. 45, pp. 24-25.

A black basaltic rock, holocrystalline, porphyritic with phenocrysts of magnetite, olivine, augite, and labradorite in a microgranular groundmass of magnetite and augite with some interstitial plagioclase and a small amount of biotite. The plagioclase of the phenocrysts encloses both the magnetite and augite. The mode of alteration of the olivine is described and its optical characters are: $\gamma - \alpha$ 0.037, $\gamma - \beta$ 0.020, $\beta - \alpha$ 0.017, 2V 83½°, optically positive. A quantitative chemical analysis is given. [The norm of this rock shows small amounts of *ne*, *lc*, and calcium orthosilicate, and no *or* or *ab*. Its composition approaches that of some 'limburgites'. Nepheline and melilite might be looked for.] W. C. S.

DIXEY (F.) & SMITH (W. Campbell). *The rocks of the Lupata Gorge and the north side of the lower Zambezi*. Geol. Mag. London, 1929, vol. 66, pp. 241-259, 1 pl. (map).

The succession described at the Lupata Gorge on the north bank of the Zambezi includes a lower series of rhyolitic lavas and an upper alkali series including phonolites, kenytes and blairmorites, and tuffs. Both sets of lavas are underlain by pebbly sandstones, the Lower and Upper Lupata Sandstones, believed to be of early Cretaceous age. The Upper Lupata Sandstones rest unconformably on the rhyolitic series. Details are given of the petrography with a chemical analysis of one of the rhyolites. As regards the alkali series many of the phonolites and some of the kenytes are similar to types from Kenya Colony. Particular interest attaches to analcime-bearing kenytes containing conspicuous crystals of analcime of Prussian-red colour and 7 mm. in diameter, in addition to the usual phenocrysts of anorthoclase and nepheline; and also to rocks with abundant large phenocrysts of analcime up to 1½ cm. across, which can be referred to blairmorite, previously described by J. D. Mackenzie from the Crowsnest volcanics in the eastern Rocky Mountains of Alberta. They differ from the original blairmorite in the absence of melanite and in the greater abundance of nepheline.

W. C. S.

MENNELL (F. P.). *Some Mesozoic and Tertiary igneous rocks from Portuguese East Africa*. Geol. Mag. London, 1929, vol. 66, pp. 529-540, 1 fig. (map).

The author has brought together the results of his own observations on volcanic rocks and minor intrusions made during the last eight years in the Mozambique Company's territory between the Buzi River and the Zambezi, immediately to the south of the district described in the preceding abstract. The igneous rocks in this area include Karroo basalts, Karroo dolerites with little or no olivine, later intrusions of dolerite rich in olivine, the Lupata volcanic series, and ultrabasic intrusions probably of late Tertiary age. The Lupata volcanic series can be traced southward until it passes beneath the Sena Sandstones which themselves pass under the Urema syncline on the eastern edge of which fossiliferous chalk of the Upper Cretaceous is seen. Borings have confirmed the presence of the Sena Series beneath the chalk in the Inyaminga anticline farther east. The rocks described from the Lupata volcanics include rhyolites, phonolites, lens-porphyry (with porphyritic anorthoclase), lupatite (a nepheline-felspar-porphyry), a rock related to the leucitophyre of Rieden, a nepheline-basalt, and a coarse-grained ijolite. Some of the rhyolites of the Lupata scarp are believed to be near pantellerites in composition. [The descriptions indicate that the 'pseudomorphs after leucite' are the same as the crystals identified as analcime in the paper abstracted above, and the lens-porphyry probably corresponds to the rocks there described as kenyte.] W. C. S.

ESENWEIN (Paul). *Zur Petrographie der Azoren*. Zeits. Vulkanologie, Berlin, 1929, vol. 12, pp. 108-227, 3 pls., 19 text-figs. [Preprints, without the plates, as:] Inaug.-Diss., Zürich, 1928, Berlin (Dietrich Reimer (Ernst Vohsen)), 1928, 128 pp., 19 figs.

A systematic description, with chemical analyses, of volcanic rocks collected in nine islands of the Azores in 1924 by I. Friedlaender. They are classified as soda-sanidine-trachyte, plagioclase-trachyte, 'plagioclase-basalt', and olivine-basalt, with one biotite-hornblende-essexite (an inclusion or 'bomb'), and an orthoclase-basalt (resulting from partial absorption of a trachytic rock by a basalt). Measured quantitative mineral compositions are compared with calculated norms. The author uses the name plagioclase-basalt for olivine-poor basalts described by G. Hartung and by R. Reinisch as trachydolerite and by O. Mügge as andesitic basalt or anorthite-

basalt. [As the term 'plagioclase-basalt' has long been in use in Germany and elsewhere for the whole family of basalts proper this attempt to correct the nomenclature is not very helpful.] The chemistry of the rocks and their differentiation is discussed by the method of Niggli, and full use is made of several of the ingenious graphical methods devised by that author. A very interesting comparison is made with all the published analyses from other islands of the Atlantic Ocean. A separation into basaltic and trachytic rocks with a scarcity of intermediate members seems to characterize all these islands. Differentiation proceeds from olivine-basalts, through 'plagioclase-basalt' to the trachytes, and crystallization-differentiation is considered to be the controlling process. Optical data are recorded for soda-sanidine, kataphorite, basaltic hornblende, several pyroxenes, and olivine. Quantitative analyses, densities, and optical data are given for augite and olivine from an 'olivine-dolerite' containing 50% of phenocrysts of these minerals. The rock is thought to be related to the atlantite of E. Lehmann and the madeirite of C. Gagel. [It is not an olivine-dolerite in the sense in which that name is used in England.] Augite (anal. I), sp. gr. 3.228, α 1.704, γ 1.729, 2V 54°, positive, $c:\gamma = 45^\circ$, $\rho > v$. Olivine (anal. II), sp. gr. 3.43, α 1.675, γ 1.714 (zoned crystals), 2V 84°–88°, negative.

	SiO ₂ .	TiO ₂ .	Al ₂ O ₃ .	Fe ₂ O ₃ .	FeO.	MnO.
I.	49.90	2.06	5.35	1.07	4.88	0.04
II.	38.77	—	trace	trace	16.83	0.22
	MgO.	CaO.	Na ₂ O.	K ₂ O.	H ₂ O+.	H ₂ O—.
I.	15.51	20.20	0.78	0.28	0.00	0.08
II.	43.80	0.51	—	—	0.12	—

W. C. S.

WASHINGTON (Henry S.). *The petrology of St. Paul's Rocks (Atlantic).*

Report on the geological collections made during the voyage of the 'Quest' on the Shackleton-Rowett Expedition to the South Atlantic & Weddell Sea in 1921–1922, London (British Museum), 1930, chapt. XII, pp. 126–144, 1 pl., 1 text-fig.

These islets (0° 55½' N., 29° 22½' W.) consist of a dark, dense, and compact peridotite, sp. gr. 3.271, composed mainly of minute grains of olivine (γ 1.690), with some pyroxene and dark-brown picotite (n 1.82–1.83). The pale-brown pyroxene has optical characters (α 1.645–1.650, β 1.650–1.656, γ 1.663–1.668, $\gamma:c$ about 31°) near to those of Burmese jadeite (α 1.650, β 1.657, γ 1.665, $\gamma:c = 34^\circ$,

2V about 75°). The pyroxene is bordered by very little actinolite (α 1.612, β 1.630, γ 1.638, $\gamma : c = 16^\circ$). The rock also contains a very small amount of serpentine, but no glass or felspar. Analysis of the rock, SiO_2 44.25, Al_2O_3 2.65, Fe_2O_3 1.13, FeO 7.11, MgO 41.07, CaO 1.07, Na_2O 1.52, K_2O 0.13, $\text{H}_2\text{O} +$ 0.66, $\text{H}_2\text{O} -$ 0.17, TiO_2 0.25, Cr_2O_3 0.10, MnO 0.09, NiO n. d. = 100.20, corresponds with the mineral composition, olivine 73.5, pyroxene 24.5 (jadeite 10, diopside 4, enstatite 10.5), picotite 2 %. 72.6 % of the rock is soluble in hydrochloric acid. With this amount of pyroxene, the rock is described as a wehrlitic dunite. The exceptional—indeed apparently unique—character of this rock is commented upon. All other oceanic islands (except coral islands) consist of volcanic rocks, mainly basalts and andesites with sometimes small amounts of trachytes and phonolites. Whether the peridotite is of plutonic, metamorphic, or volcanic origin is discussed in detail: a plutonic-metamorphic origin is considered to be the most probable. A description of a phosphate rock is also given [M.A. 4-235].

L. J. S.

Economic Minerals and Ore-deposits.

TARR (W. A.). *The origin of the zinc deposits at Franklin and Sterling Hill, New Jersey.* Amer. Min., 1929, vol. 14, pp. 207-221.

The original deposit is supposed to have been a bedded deposit of sulphide ores of the usual type in pre-Cambrian limestone. By oxidation these would give oxides and hydroxides of iron and manganese, hemimorphite, smithsonite, and rhodochrosite. The metamorphism by heat and pressure of such an oxidized ore resulted in the formation of the franklinite-willemitite-zincite ore.

L. J. S.

COLEMAN (A. P.), MOORE (E. S.), & WALKER (T. L.). *The Sudbury nickel intrusive.* Univ. Toronto Studies, Geol. Ser., 1929, no. 28, 55 pp., 3 pls.

A review is given of the literature, and the theory of magmatic segregation, as opposed to the hydrothermal theory, of the copper-nickel ore is defended. Many new chemical analyses of the rocks taken along several traverses show a gradual transition from norite at the edge of the basin into micropegmatite towards the centre. The sulphides (pyrrhotine, pentlandite, and chalcopyrite) occur as blebs in the fresh norite and are concentrated at the base of the norite.

L. J. S.

- GREGORY (J. W.). *The nickel-cobalt ore of Talnotry, Kirkcudbrightshire.* Trans. Inst. Mining Metall. London, 1928, vol. 37 (for 1927-8), pp. 178-182, 2 pls., 1 text-fig. With an appendix by: LEITCH (Duncan). *The metallic minerals of the Talnotry deposit.* Ibid., pp. 183-186, 1 pl., 2 text-figs.

This deposit was prospected in 1885, but no large quantity of ore was proved. It has been described as a magmatic segregation at the base of a diorite sill. The author proves that it is a lode deposit along a fault at the junction of an altered diorite and baked Silurian shales and greywacke, and not far from a granitic mass (adamellite). Away from the lode the diorite shows no trace of nickel or cobalt, and the sulphides were deposited later than the silicate minerals. The ore-minerals are niccolite, smaltite, chalcopyrite, and pyrrhotine.

L. J. S.

- McKINSTRY (H. E.). *Interpretation of concentric textures at Colquijirca, Peru.* Amer. Min., 1929, vol. 14, pp. 431-433, 3 figs.

A false impression as to the order of deposition of minerals in an ore may sometimes be given by an examination of polished sections under the microscope. The concentric structures in this ore from Peru are also shown in the linings of cavities. Crystals of tennantite on the walls are coated with alternate layers of galena and blende. The galena has been partly replaced by chalcopyrite, and later there has been a deposition of stromeyerite on the chalcopyrite and replacing the tennantite core.

L. J. S.

- STILLWELL (F. L.). *Observations on the mineral constitution of the Broken Hill lode.* Proc. Australian Inst. Mining & Metall., 1926, new ser., no. 64, pp. 97-172, 15 pls., 16 text-figs.

The argentiferous ore now worked at Broken Hill, New South Wales, consists of a granular mixture of blende and galena, other minerals being quite inconspicuous. Polished sections of the ore were examined under the microscope by the metallographic method, and, with the aid of etching and chemical tests, the following minerals were identified: pyrite, mispickel, willyamite, an unknown Ni-Co-Sb mineral (perhaps the orthorhombic equivalent of willyamite), enargite, pyrrhotine, cubanite, chalcopyrite, tetrahedrite, chalcostibite, dyscrasite, meneghinite, pyrargyrite, berthierite, argentite, covellite, and marcasite. These occur in small amount enclosed in or intimately intergrown with the blende and galena. Gangue minerals present in the granular aggregate are garnet, rhodonite, and calcite.

L. J. S.

FREBOLD (Georg). *Ueber einige Mineralien der Enargitgruppe und ihre paragenetische Verhältnisse in der Kupfererzlagstätte von Mancayan auf Luzon (Philippinen)*. Neues Jahrb. Min., Abt. A, 1927, vol. 56, pp. 316-333.

The characters shown on polished sections of enargite, famatinite, luzonite, and sulvanite are described. Enargite crystals from Sierra de Famatina agree with rose or α -enargite; and massive enargite from Tsumeb, South-West Africa shows green or β -enargite penetrating α -enargite. Luzonite, reddish-brown and massive, from Mancayan, proves to be a mixture of enargite and famatinite; this is confirmed by X-ray powder photographs. The paragenetic relations of the minerals present in two specimens of copper ore from Mancayan were determined on polished sections.

L. J. S.

ORCEL (J.). *Notes sur des caractères microscopiques des minéraux opaques, principalement en lumière polarisée*. (Première note.) Bull. Soc. Franç. Min., 1928, vol. 51, pp. 197-210, 3 pls.

The microscopical characters on polished sections [M.A. 3 400] are described for boulangerite, jamesonite, berthierite, cubanite, livingstonite, chalcostibite, enargite, luzonite, famatinite, sulvanite, lautite, and various arsenides of nickel and cobalt.

F. A. B.

GUILD (F. N.). *Some microscopic features of the silver minerals*. Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 135-142, 8 figs.

Recapitulation and further observations on the silver minerals as seen on polished surfaces of ores, and the relations of the minerals to one another [M.A. 1-199].

L. J. S.

NYE (P. B.). *The osmiridium deposits of the Adamsfield district*. Tasmania Geol. Survey Bull., 1929, no. 39, iv + 74 pp., 1 map. Price 2s. 6d.

Osmiridium was discovered in the Adamsfield district, Arthur Co., south-west Tasmania in 1925, the mode of occurrence being of the same type as in north-west Tasmania [M.A. 2-442]. It is found in alluvial deposits and in the hill-wash from a large dike of serpentine in Silurian sediments. In the serpentine-rock are narrow veins and small patches of a greenish-grey coarse-grained enstatite-rock. Analysis of this enstatite gave SiO_2 55.36, Al_2O_3 5.28, Fe_2O_3 2.82, FeO 3.02, MgO 32.10, ign. 1.30 = 99.88. Grains and small octahedra of chromite are abundant in the serpentine and in the enstatite-rock,

and osmiridium has been found attached to chromite and to gold; but only one small specimen has been found showing grains of osmiridium actually in the serpentine. A dark-grey nickeliferous pyrite (S 42.07, Fe 21.60, Ni 21.80, Co 0.30 % &c.) and bright yellow millerite (Ni 56.0, Fe 2.0 %) occur intimately associated with chromite in the gravels. The osmiridium occurs as grains suitable for use as pen-points; the largest nugget found weighs 48 grams. The average of thirty-one analyses tabulated is Ir 41.65 (range, 36.30–44.35), Os 45.51 (43.31–50.20), Ru 6.40 (5.29–10.60), Pt 1.12 (0.50–2.00), Rh 0.29, Pd trace, Au 0.002, indicating the nevyanskite variety with Ir: Os near 1:1. The total production to August 1928 has been 7,666 ounces, and the local price has varied from £26 to £30 per ounce.

L. J. S.

LANDES (Kenneth K.). *The strontium occurrence near La Conner, Washington.* Amer. Min., 1929, vol. 14, pp. 408–413.

Massive celestine occurs with calcite in a vein in a shattered faulted zone in dunite with pyroxenite on Fidalgo Island, Skagit Co. It alters to strontianite along cleavage cracks, and the product has a cellular or reticulated structure. Water-worn fragments of the celestine show an eight-faced form, due to the solution by sea-water along a macrodome and a brachydome. The occurrence of strontium minerals in an igneous rock is unusual; they are here probably of hydrothermal origin.

L. J. S.

Abrasives. Imperial Institute, The Mineral Industry of the British Empire and of Foreign Countries, London, 1929, 67 pp. Price, 2s. 6d.

A useful summary arranged under the headings: diamonds, corundum, emery, garnet, silica abrasives, pumice and volcanic dust, giving in each case the uses, occurrence and distribution, and the world's production. A detailed bibliography (pp. 62–67) is arranged according to 'General, preparation and uses' and under the different countries.

L. J. S.

TRISCHKA (Carl), ROVE (Olaf N.), & BARRINGER (D. Moreau, Jr.). *Boxwork siderite.* Econ. Geol., 1929, vol. 24, pp. 677–686, 4 figs.

A cellular rock in large quantities underlies bodies of oxidizing sulphide ores in the mines at Bisbee, Arizona. It consists mainly of slabs or sheets of chalybite with angular spaces or minute pores

between. It has been formed by the action of ground-water carrying sulphuric acid and iron sulphate (derived by the oxidation of the sulphide ores) on beds of limestone, the solution penetrating along the bedding planes and crevices in the rock. A similar structure is also shown by smithsonite.

L. J. S.

AUBEL (René van). *Sur les minerais de cuivre de la Haute-Lufira (Katanga Congo-belge)*. Bull. Soc. Franç. Min., 1928, vol. 51, pp. 161-165, 2 pls.

A polished section of copper ore from the Lufira-Muperera confluence, south of the principal copper zone of Haut-Katanga, shows primary pyrite and chalcopyrite. Fissures in the pyrite are filled with orthorhombic or β -chalcosine the product of cementation, together with a little covellite, whilst at the edges of the chalcosine, carbonates, quartz, and limonite are observed. A second section of the same composition shows, after heating to a low temperature, a little cuprite replacing malachite, haematite instead of limonite, and the cubic variety α -chalcosine. Bornite is formed where the pyrite is in contact with the chalcosine. Differences in the colour of the bornite are due to separation of chalcosine during cooling from a solution of the latter in bornite. The fact that α -chalcosine is observed in this section after cooling down and not the β -variety, which is stable at room temperatures, is probably due to the protective action of the bornite on the cubic variety.

F. A. B.

DOUGLAS (G. Vibert). *On the structural relationships and genesis of the pyritic ore-bodies of Huelva*. Geol. Mag. London, 1929, vol. 66, pp. 302-316, 13 figs.

The ore-bodies are associated with intrusions of porphyry and may be grouped as (a) massive sulphides with slate walls, (b) contact bodies between porphyry and slate; (c) stockwork and disseminated sulphides entirely in porphyry; and (d) veins carrying sulphides. The contact ore-bodies have been found to rest on brecciated porphyry. The extent of brecciation is slight where the intrusions follow the slaty cleavage but is considerable where the slaty cleavage is transgressed by the wall of the intrusion, and both the slate and the porphyry become brecciated. This brecciation renders both porphyry and slate permeable to the mineralizing solutions and the slate is intensely altered. Structural conditions favourable to contact ore-bodies and stockworks are therefore to be found where the dip of the slaty cleavage is towards the porphyry and (or) where roof pendants

of slate are found in the intrusive rock. The author agrees with several previous authors in ascribing the ore-deposits to replacement by hydrothermal solutions. [See M.A. 2-548.] Observations made on a visit to Sulitjelma and Orkla have convinced him that the Norwegian pyritic deposits are also due to hydrothermal solutions, and not to magmatic injection as held by J. H. L. Vogt and others.

W. C. S.

AUBERT DE LA RÛE (E.). *Observations sur les gisements de manganèse de la Côte d'Ivoire*. Bull. Soc. Franç. Min., 1928, vol. 51, pp. 275-284.

Manganese minerals from the Ivory Coast are associated with spessartine-bearing quartzites and appear to be derived from the alteration of the garnet. The chief outcrops of the quartzite are described and compared with the spessartine-quartz-rocks of the neighbouring Gold Coast Colony [M.A. 3-28, 3-128] and with the gondites of India. The manganese deposits so far encountered are not of economic importance.

F. A. B.

NEL (Louis T.). *The geology of the Postmasburg manganese deposits and the surrounding country*. Union of S. Africa, Geol. Survey [Special Publication], 1929, 104 pp., 12 pls., 11 text-figs., map (two sheets) on scale of 1:59,501. Price, with map, 10s. 6d.

This is the complete account by the Geological Survey of these deposits, of which a preliminary account has already been given [M.A. 3-396]. The Campbell Rand dolomite and the Griquatown beds form a broad anticline with its western limb complicated by faults and flexures. The Gamagara beds rest unconformably on these older beds, and form a range of hills—the Gamagara ridge. Manganese deposits occur at the base of the Gamagara beds and also at a lower horizon in the Klipfontein ridge farther east; but the deposits in the Gamagara ridge are much more extensive and continuous. There are two principal varieties of ore, one massive and corresponding to psilomelane, the other crystalline and containing braunite; but the two minerals are intermixed and also associated with haematite. The only harmful impurity in the ore is iron. The average iron content is between 7 and 14 %, but there are extensive deposits containing less than 7 % of iron, and this rich ore can be readily sorted from the inferior stuff. Twelve analyses and many assays of the ore are given. Minerals associated with the ore are a slightly manganiferous diaspore (formerly reported as rhodonite

[M.A. 4-148]), a manganiferous mica, and an unidentified mineral forming minute hexagonal prisms. In the Gamagara beds there are some highly aluminous shales which carry crystals of diaspore, sometimes a centimetre in diameter, and little tetrahedra of zunyite. Both minerals are described, with analyses. S. J. S.

MORGAN (S. C.). *The geology of the Gaika gold mine, Que Que, S. Rhodesia*. Southern Rhodesia, Geol. Survey Bull., 1929, no. 14, 42 pp., 1 map, 4 pls., 2 text-figs.

The Gaika mine is situated about halfway between Bulawayo and Salisbury; its modern history began in 1902, but it is on the site of a large group of old workings of unknown age. The mine operates in the same belt of Basement Schists as the Cam and Motor, the Globe and Phoenix, and other famous gold-producers. About the Gaika mine the schist belt is more than 600 yards wide, and it is composed mainly of serpentine, talc-carbonate rocks, and massive magnesite. The serpentine sometimes contains small seams of asbestos, and microscopic study shows it to have been derived from various types of peridotite. The talc-carbonate rock probably underlies the greater part of the area round the mine; it passes gradually into serpentine on the one hand and into magnesite on the other, and it is believed to be an alteration product of the serpentine. The magnesite rock occurs in lenses in the talc-carbonate rock and forms the core of the ridge in which the ore-bodies occur. All these rocks have been extensively silicified, and they are cut by dikes of greatly altered diabase and porphyrite. The ore-bodies are stockworks and impregnations located about fissures which sometimes have a filling of glassy quartz; the direction of the fissures is approximately parallel to the junction between the schists and the surrounding granite. The payable ore is mostly confined to quartz veins and stringers in the magnesite rock. Stibnite is sometimes associated with the gold. Between 1905 and 1928 the mine produced 395,024 ounces of gold. S. J. S.

HAUGHTON (S. H.) & FROMMURZE (H. F.). *Notes on the occurrence of argentiferous galena near Aiais, Warmbad district, S. W. Africa*. Trans. Geol. Soc. S. Africa, 1930, vol. 32 (for 1929), pp. 89-102, 1 fig.

A basement of steeply dipping schists and gneisses is invaded by a body of pegmatitic granite from which veins of pegmatite radiate. There are also dikes of bostonite, camptonite, diabase, and quartz-

porphyry, and a number of small intrusive masses which are interpreted as plugs. These contain rocks of many types, but among them lamprophyres are conspicuous. Veins of argentiferous galena are sometimes associated with the dikes, sometimes independent of them, and the more-important veins are clustered in a comparatively small area around two of the plugs. The veins are narrow and dip almost vertically. Associated with the galena are cerussite, anglesite, calamine, malachite, chrysocolla, and sometimes gypsum and native sulphur. In one lode only, the ore is accompanied by baryte and fluorspar. Assays of the hand-picked ore show 64 to 112 oz. of silver per ton.

S. J. S.

MENNELL (F. P.) & FROST (A.). *Notes on the occurrence of platinum in the Great Dyke of Southern Rhodesia with special reference to Belingwe and Selukwe.* Proc. Rhodesian Sci. Assoc., 1926, vol. 25 (for 1925-26), pp. 2-8, 2 pls.

Briefly describes the rocks forming the 'Great Dyke' and explains the field relations. A sketch-map of the Belingwe area shows that one of the apparent curves in the course of the dike is definitely due to lateral displacement by faulting. The authors believe the 'Great Dyke' to be a true dike with synclinal pseudo-stratified layers. The platinum occurs in pyroxene-norite which on Bolikwa Hill weathers into platy layers in the actual carrying band. Some details are given of the results of panning. The free platinum is often yellowish in colour. An analysis of the rock ('ore') from Belingwe, which shows 2 dw. platinum to the ton, is given. [Cf. M.A. 3-76.]

W. C. S.

Miscellaneous.

VENDL (Mária). *Kalcitok Szentgálról és Márkházáról.*—VENDL (Marie). *Über Kalzite von Szentgál und Márkháza.* Földtani Közlöny, Budapest, 1929, vol. 58 (for 1928) pp. 70-76 [Hung.], 6 figs., p. 205 [Germ. Summary].

VENDL (Marie). *Über Calcite von Szentgál und Márkháza in Ungarn.* Centralblatt Min., Abt. A, 1928, pp. 113-120, 6 figs.

Calcite crystals on limestone from Szentgál (com. Veszprém, Hungary) showed fourteen forms of which ι . (03 $\bar{3}$ 4) and $\mathfrak{z}$ (13.24. $\bar{3}$ 7.10) are new. Crystals on limestone from Márkháza (com. Nógrád) showed six forms with new E. (0.17. $\bar{1}$ 7.2) [Dana's axes]. L. J. S.

GORDON (Samuel G.). *Calcite from the French Creek iron mines, Chester County, Pennsylvania*. Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 108–116, 3 figs., 2 pls.

Five habits of crystals, showing in all 31 forms, are distinguished. New forms are γ ($\overline{3}1.\overline{1}6.47.8$), $\otimes$ ($\overline{7}6.13.2$), and Ω ($12.2.\overline{1}4.3$) [$a:c = 1:0.8543$]. A new type of compound crystal is described as 'symmetrical parallel allomorphic pairs,' i. e. parallel growths of two individuals, each with different faces. L. J. S.

HELLER (Florian). *Über Calcitkrystalle aus fränkischen Höhlen*. Festschrift Victor Goldschmidt, 1928, pp. 143–146, 1 pl., 9 text-figs.

Calcite crystals (to 1 cm.) in the debris on the floor of a limestone cavern near Weissenburg in Bavaria are bounded by an acute negative rhombohedron (near $-22R$) and basal pinakoid, with rough and corroded faces. Analysis shows CaCO_3 97.04, SO_3 0.34 % &c., and it is thought that the unusual habit of the crystals may perhaps be due to the presence of sulphate. L. J. S.

WASHINGTON (Henry S.). *Dahllite from St. Paul's Rocks (Atlantic)*.¹ Amer. Min., 1929, vol. 14, pp. 369–372.

These islets ($0^\circ 55\frac{1}{2}'N.$, $29^\circ 22\frac{1}{2}'W.$) consist of dunite with a covering of guano. A phosphate rock filling veins in the dunite is pale yellow and compact with a minute spherulitic structure. The fibres of the spherules are optically uniaxial, ω 1.603 ϵ 1.598, and they give an X-ray pattern identical with that of fluor-apatite. Analysis gave P_2O_5 35.75, CaO 56.47, MgO 0.30, SiO_2 0.01, $\text{H}_2\text{O} + 3.91$, $\text{H}_2\text{O} - 0.53$, CO_2 3.36, SO_3 0.36 = 100.69. Deducting 0.9 % of gypsum, this gives a formula $40\text{CaO}.10\text{P}_2\text{O}_5.8\text{H}_2\text{O}.3\text{CO}_2$, which is near the general formula $3\text{Ca}_3\text{P}_2\text{O}_8.\text{Ca}(\text{CO}_3, [\text{OH}]_2)$ for dahllite. L. J. S.

HIMMELBAUER (A.). *Krystallographische Untersuchungen an einigen afrikanischen Topasvorkommen*. Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 147–153, 4 figs.

Colourless to pale blue-green crystals (up to 4 cm. across) of topaz from Klein Spitzkopje, near Usakos, South-West Africa show the forms $cbm MlgXfyhdiuo$ [Dana's letters]. Sketches are given of the figures of growth on the faces and of the light-figures. Crystals from 'Neu Schwaben' do not differ from those from Klein

¹ Advance publication from the Report of the 'Quest' Expedition, London 1930, pp. 141–144 [M.A. 4–226].

Spitzkopje. Three crystals from the Rukuba tin mine, Bauchi, Northern Nigeria, gave the forms *c b m l g f y h d u o*. L. J. S.

MÜLLER (Karl). *Danaitzwilling von Sulitelma (Norwegen)*. Festschrift Victor Goldschmidt, 1928, pp. 186-188, 2 figs.

The danaite crystals show the forms *m q n* [Dana's letters for mispickel] and are twinned on *e* (101). [Cf. Min. Mag. 14-54.]

L. J. S.

MATTHES (O.) & OBERFÖLL (L.). *Epidot von Alaska*. Festschrift Victor Goldschmidt, Heidelberg, 1928, pp. 175-178.

Measurement of four simple crystals and nine twins from Prince of Wales Island showed the presence of twenty-one forms. [Cf. M.A. 4-88.]

L. J. S.

GRUNER (John W.). *Structural reasons for oriented intergrowths in some minerals*. Amer. Min., 1929, vol. 14, pp. 227-237, 5 figs.

The regular intergrowths that have been observed under the metallographic microscope for the following pairs of ore-minerals are discussed in the light of the crystal-structure of these minerals: magnetite-ilmenite, magnetite-haematite, haematite-ilmenite, magnetite-spinel, blende-chalcopryrite, chalcopryrite-bornite, bornite-chalcosine, chalcopryrite-pyrrhotine, chalcopryrite-stannite, chalcopryrite-cubanite, silver-dyscrasite. It appears that intergrowth takes place only on those crystallographic planes in which the atomic arrangement and spacing are almost alike. The contact plane seems to be a plane of oxygen or sulphur atoms that is common to the two structures. Regular intergrowths have not been observed in the frequent pyrrhotine-pentlandite mixtures, and here there are marked differences in the two structures.

L. J. S.

FISHER (Lloyd W.). *Chromite: its mineral and chemical composition*. Amer. Min., 1929, vol. 14, pp. 341-357, 8 figs.

A discussion of 150 published analyses of chromite shows that pure $\text{FeO.Cr}_2\text{O}_3$ is rarely approached. The mineral is a mixture of various spinels belonging to different isomorphous series. L. J. S.

GUILD (F. N.). *Copper pitch ore*. Amer. Min., 1929, vol. 14, pp. 313-318.

This black lustrous coal-like colloidal mineral consists of mixtures in varying proportions of several hydrous oxides with silicates and carbonates. Five types are distinguished: (1) Hydrous oxides of

copper and iron, grading into limonite, (2) Copper oxide and chrysocolla, grading into chrysocolla, (3) Copper and manganese oxides, more or less hydrated, with some silica, (4) Hydrous oxide of copper, grading into melanochalcite, (5) Grading into chalcedony. Analysis of material from Globe, Arizona, gave SiO_2 24.64, Al_2O_3 3.10, Fe_2O_3 1.73, CuO 33.68, MnO 19.19, ZnO trace, CaO 0.84, loss on ignition 17.76 = 100.94. Material found in large quantities at Huerta Arriba, Burgos, Spain, gave SiO_2 5.75, Fe_2O_3 4.40, CuO 62.3, MnO nil.

L. J. S.

SCHALLER (Waldemar T.). *The properties and associated minerals of gillespite*. Amer. Min., 1929, vol. 14, pp. 319-322.

No further specimens of gillespite [M.A. 1-375] have been found. The mineral is tetragonal with cleavages (001) good, (100) poor; ω 1.619, ϵ 1.618. The scales of hydrated silica left when the mineral is treated with HCl vary in their water content and refractive index. The rock is composed of gillespite 64, celsian 15, hedenbergite (not diopside) 15, quartz 6 %, and two undetermined minerals in minute quantity. Analysis of the celsian gave SiO_2 33.9, Al_2O_3 25.6, BaO 37.7, insol. 0.4 = 97.6; α 1.584, β 1.589, γ 1.596, $2V$ near 90° , positive, $\alpha:\gamma = 30^\circ$. The hedenbergite gave SiO_2 50.8, Al_2O_3 2.9, FeO 18.1, CaO 22.2, BaO 0.0, MgO 6.6 = 100.6; α 1.704, β 1.714, γ 1.735.

L. J. S.

HENDERSON (E. P.). *Gearksutite from Virginia*. Amer. Min., 1929, vol. 14, pp. 281-285.

Gearksutite has been found as small white nodules in a white clay in Trenton (Ordovician) limestone between Hot Springs and Warm Springs. Under the microscope it shows minute matted fibres with n about 1.45. Analysis, Al 15.09, Ca 22.15, Na 0.20, K 0.05, F 40.20, H_2O 15.52, O 5.42, insol. 0.96 = 99.59, agrees with the formula $\text{CaAl}(\text{F},\text{OH})_5\cdot\text{H}_2\text{O}$, with $\text{F}:\text{OH} = 3:2$, whereas earlier analyses show $\text{F}:\text{OH} = 2:1$ [cf. Min. Mag. 19-23]. The mineral has doubtless been formed by the action on clay of hot spring water charged with calcium fluoride.

L. J. S.

FAIRBAIRN (W. M.). *Celestine in central Ontario*. Amer. Min., 1929, vol. 14, pp. 286-289.

Several localities for celestine in central Ontario are enumerated. Near Kingston it occurs as nodules in Palaeozoic limestone. Although strontium sulphate is appreciably soluble in water, it does

not appear that these celestine nodules have been formed by leaching from the limestone, since no trace of strontium could be detected in the limestone.

L. J. S.

KLEVER (E.). *Neuere Untersuchungen über die Entwässerung des Kaolines im Zusammenhang mit der Mullitfrage*. Glastechnische Berichte, herausgegeben von der Deutschen Glastechnischen Gesellschaft, Frankfurt am Main, 1929, vol. 7, pp. 85-90, 8 figs.

A thermal method is described for following the course of the reactions involved in dehydrating kaolin. The heat of solution of kaolin from Zettlitz, Bohemia, in 40 % solution of hydrofluoric acid was obtained at room-temperature and also of the product obtained by heating the kaolin for three hours in a dry atmosphere at constant temperature. Numerous readings were taken over a range of temperatures up to 1100° C. The heats of solution of SiO_2 , Al_2O_3 , and Al_2SiO_5 were also obtained. At 1050°-1100° C. the heat of solution of the kaolin product is equal to the sum of the heats of solution of Al_2O_3 and 2SiO_2 , in agreement with the fact that at this temperature complete decomposition of kaolin takes place. At 600° C. an endothermal compound, metakaolin, is formed from kaolin with a heat of reaction of -15.8 kcal./mol. The calorimetric-bomb method confirms this result. Metakaolin does not decompose till a temperature of 900° C. is reached; it was not possible to carry the measurements above the temperature of complete decomposition of metakaolin, viz. 1100° C. From the above data it is also clear that sillimanite is an exothermal compound (heat of reaction = +46 kcal./mol). The author discusses the bearing of his results upon recent work on the sillimanite-mullite question.

F. A. B.

DITTLER (E.). *Neue Beryllaufschlüsse in der Masullschlucht, Südtirol*. Min. Petr. Mitt. (Tschermak), 1929, vol. 40, pp. 188-189.

Massive white beryl has been found in considerable quantity apparently in a pegmatite in crystalline schists in the Masull ravine near Merano. Sp. gr. 2.703, n_ω 1.571. Analysis by F. Schwarz gave SiO_2 66.55, Al_2O_3 18.82, BeO 13.47, FeO and CaO traces, Na_2O 1.04, K_2O 0.14, $\text{H}_2\text{O} + 0.11 = 100.13$.

L. J. S.

HARBICH (Egon). *Über einen chromhaltigen Smaragdit aus Südserbien*. Min. Petr. Mitt. (Tschermak), 1929, vol. 40, pp. 191-192.

Finely fibrous emerald-green actinolite occurring with chromite and magnesite in serpentine near Veles, Serbia, has sp. gr. 3.022, mean n 1.612, $c : \gamma = 16^\circ - 19^\circ$; pleochroism γ yellow-green, α and

β grass-green. Analysis gave SiO_2 49.74, TiO_2 0.40, Al_2O_3 8.70, Cr_2O_3 2.30, Fe_2O_3 3.07, MnO 0.04, MgO 20.44, CaO 13.32, Na_2O 1.20, $\text{H}_2\text{O} + 1.52 = 100.73$. The associated chromite gave, after deducting 10.37 % smaragdite, Al_2O_3 15.70, Cr_2O_3 55.00, FeO 18.86, MgO 9.20, CaO 1.24.

L. J. S.

HESS (Frank L.). *Oölites or cave pearls in the Carlsbad caverns.*

Proc. U.S. Nat. Mus., 1929, vol. 76, art. 16, 5 pp. 8 pls.

Balls of calcite 1.5 – 30 mm. in diameter are found loose in small pools in limestone caves at Carlsbad, New Mexico, U.S.A. The surface is either smooth and polished or rough and dull. In section the balls show a concentric structure. They were evidently formed in moving water supercharged with $\text{Ca}(\text{HCO}_3)_2$. Mention is made of oolitic structure in other materials—phosphate-rock, iron-ores, sulphur, hail, nickel (prepared from nickel carbonyl).

L. J. S.

ROGERS (Austin F.). *Polysynthetic twinning in dolomite.* Amer. Min., 1929, vol. 14, pp. 245–250, 11 figs.

Dolomite from Tilly Foster mine, Brewster, New York, and several other localities shows lamellar twinning on one, two, or three faces of the acute rhombohedron $f(02\bar{2}1)$, giving rise to striations parallel to both the shorter and longer diagonals of the cleavage face. This is also sometimes a plane of parting. The same twinning is often to be seen in thin sections of metamorphic dolomite-rocks. The directions of the twin-lamellae serve to distinguish dolomite and calcite (which shows lamellar twinning on $e(01\bar{1}2)$ with striations parallel to the longer diagonal and to an edge of the cleavage rhombohedron).

L. J. S.

CARPENTER (H. C. H.) & TAMURA (S.). *The inner crystal structure of some native metals.* Trans. Inst. Mining Metall. London, 1928, vol. 37 (for 1927–8) pp. 365–386, 8 pls. (Discussion, pp. 386–405.)

Polished and etched sections of copper, silver, and gold, all show twin-lamellae, which are of secondary origin and due to strain. When annealed at 650°C . they show signs of re-crystallization and 'annealing twins'. Native antimony, bismuth, and platinum were also examined. Sections of the Cañon Diablo meteoric iron are figured and described. The structure appears to be primary and probably originated by very slow cooling from a high temperature (about 1500°C .). Neumann bands, seen only in the kamacite, are due to strain, and were perhaps developed by the impact of the

meteorite on the earth's surface. When the sections are heated to 800° C. and slowly cooled the Neumann bands and also the crystals of cohenite disappear; and taenite and plessite show a tendency to diffuse into the kamacite, producing a martensitic acicular structure (Ni 6.31, Fe 93.2 %). L. J. S.

ROGERS (Austin F.). *Periclase from Crestmore near Riverside, California, with a list of minerals from this locality.* Amer. Min., 1929, vol. 14, pp. 462-469, 11 figs.

A white medium-grained crystalline limestone shows spots of brucite (forming the rock predazzite) with some chondrodite, wilkeite, and spinel. A few of the brucite patches show a small residual nucleus of periclase. These pseudomorphs of brucite after periclase show rounded forms (111), (110). A list of 66 minerals recorded from Crestmore is added, with references to the literature. L. J. S.

MACHATSCHKI (Felix). *Über die Formel des Risörites und Fergusonites.* Zeits. Krist., 1929, vol. 72, pp. 291-300.

The structure of risörite is identical with that of fergusonite [M.A. 3-346], and it may be regarded as a titaniferous variety containing little or no uranium. The general formula is written as $XZ(O,OH)_4$, where $X = Nb, Ta, Al, Ti, Be, Mg, Si$, and $Z = Ca, Yt, Er, Ce, La, Di, U, Th, Zr, Sn, Mn, Fe$, these elements, regarded as isomorphous, being grouped according to atomic size regardless of valency. Similarly, for the euxenite-polycrase and blomstrandine-priorite series the general formula is written $XZ_2(O,OH)_6$, and for the pyrochlore group $X_2Z_2(O,OH,F)_7$. L. J. S.

WHITLOCK (Herbert P.). *Danburite from Obira, Japan.* American Museum Novitates, 1929, no. 374, 10 pp., 4 figs.

Measurement of five crystals showed the presence of 49 forms, 31 of which are recorded as new for danburite. L. J. S.

WHITLOCK (Herbert P.). *A crystallographic note on greenockite from West Paterson, New Jersey.* American Museum Novitates, 1929, no. 372, 2 pp., 2 figs.

A few small (2 mm.) dark reddish-brown crystals have been found on prehnite. The crystal measured showed the forms $c\rho xzs$ [Dana's letters] at one end and cx at the other, with short prism m between. The axial ratio obtained, $a:c = 1:0.8115$, proves the crystal to be greenockite rather than wurtzite. A crystal twinned on $s(11\bar{2}1)$ is also figured. L. J. S.